Electrical World

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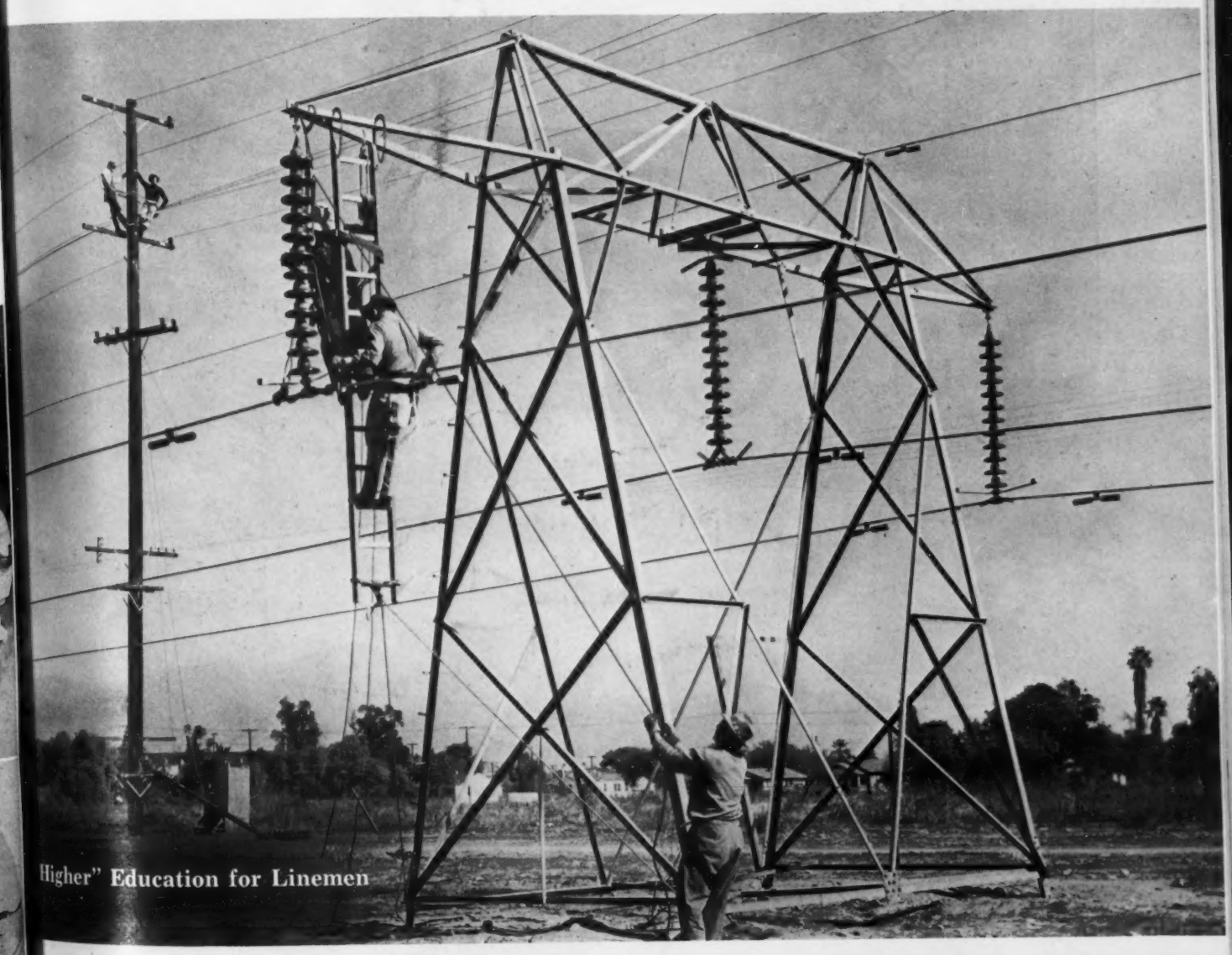

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MARCH 1, 1947

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Electrical World

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March 1, 1947 — Vol. 127, No. 9

Contents

This Week's Cover Picture
Apprentice linemen practice use of ladders and line tools on replica of tower top at Southern California Edison school. See page 52.

Editorials .....41 and 50
News of the Electrical World..... 42
Washington Comment 51
Super School for Linemen..... 52
Crankshaft Positioning Alleviates Compressor Vibration.... 55
G. SPILLANE, General Electric Co.
Boiler Conversion Eases Fuel Crisis..... 57
PAUL B. JUHNKE, Commonwealth Edison Co.
Effective Standardization of Water Heaters Is Needed..... 58
HERVEY A. BROWN, The Cleveland Heater Co.
Remote Control of Street Lighting..... 61
F. R. MILLER, The United Illuminating Co.
Conventional Conductors Used on 4,614-Ft. Span..... 62
F. P. KASPAR, Oklahoma Gas & Electric Co.
Analyzer Charts Performance of Hydraulic Governors..... 64
B. F. GOSTIN, Tennessee Valley Authority.
City-Wide School Lighting Promotion Gets Results..... 66
ROY H. KNOX, Birmingham Electric Co.
HOW 68
Engineering Reference Sheet..... 72
Digests 87
Load Building..... 88
New Equipment 94
News About People..... 99
Manufacturers and Markets..... 104
Index of Advertisements..... 122

ELECTRICAL WORLD Published weekly. Price 35 cents a copy. Publication office 99-129 N. Broadway, Albany 1, N. Y. Allow at least ten days for change of address. Address communications about subscriptions to J. E. Blackburn, Jr., Director of Circulation. **Return Postage Guaranteed.** Subscription rates: In the United States, $6 a year, $9 for two years, $12 for three years. Canada $7 for one year, $11 for two years, $14 for three years (Canadian money at par). Pan-American countries $15 for one year, $25 for two years, $30 for three years. All other countries $20 for one year, $30 for two years, $40 for three years. Please indicate position and company connection on all subscription orders. Entered as second class matter November 16, 1936, at Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in the U. S. A. Contents copyrighted, 1947, by McGraw-Hill Publishing Co., Inc. All Rights Reserved. Branch Offices: 520 North Michigan Avenue, Chicago 11, Ill.; 68 Post Street, San Francisco 4; Aldwych House, Aldwych, London, W. C. 2; Atlanta, Ga.; Boston, Cleveland, Detroit, Los Angeles, Philadelphia, Pittsburgh, St. Louis, Washington.

McGRAW-HILL PUBLISHING CO., INC.
JAMES H. McGRAW
Founder and Honorary Chairman

Publication Office.....99-129 N. Broadway, Albany 1, N. Y.
Editorial and Executive Offices.....330 West 42nd St., New York 18, N. Y.
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QUICK RELIEF for the BUILDING WIRE SHORTAGE

approved by N. E. C.

..here are some of the facts:

- Worldwide shortage of copper shows strong evidence of continuing through '47, maybe longer, thus prolonging present difficulties on deliveries of the heavier sizes of conductors.
- Because of its high conductivity and excellent record for durability, aluminum is the natural substitute.
- Current carrying capacity of aluminum Performite Building Wire, Type RH, equals that of copper Hazacode, Type R. The 16% difference in conductivity between copper and aluminum is compensated for by the temperature rating spread between the two types of insulation.
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- Aluminum Type RH Wire costs no more than copper Type R because the higher cost of the better grade Performite Type RH rubber is offset by the lower cost per 1000 feet of aluminum.
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- Quick relief for the building wire shortage is now provided on sizes No. 6 Awg and larger Hazard Aluminum Performite Building Wire Type RH, where approved by local inspection authorities.

TO GET ALL THE FACTS, write for technical Bulletin H-407, illustrated above, which gives tables of capacities; comparative weights, data on characteristics; information for quick determination of voltage drop, conductor sizes, circuit length and currents for both aluminum and copper. Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

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Electrical World

MARCH 1, 1947

Don't Cripple Electrical Manufacturing

UNIFIED and immediate government action is needed if a real copper crisis is to be averted. Copper supply in the immediate future imperils the whole industry. It is becoming increasingly alarming and can reach crisis stage almost immediately.

This situation results mainly from two factors:

1. The ever-increasing demand by industry as reconversion problems have been solved.

2. Failure of the federal government to recognize the problem as one which would continue well into peace time.

The first point is simple and understandable. As more and more goods were needed by more and more people, it was to be anticipated that more and more copper would be required. This is exactly what happened. Consumption now equals that of the war period. Currently, it is running again at about 130,000 tons monthly.

Domestic mines have been averaging 65,000 tons per month. Metal Reserves Corporation has been importing about 50,000 tons monthly and allocating it to industry. The remainder, 15,000 tons, came from scrap and stocks.

However, the second point is not so simple nor so easily understood. Consumption, production and stock-pile figures are readily available and widely publicized. Why hasn't some action been taken? Could it be political? Could it be lack of foresight? Let's see.

During 1946 the federal government was releasing approximately 50,000 tons of foreign copper per month from current imports and stock. The stock pile was thereby cut sharply from about 550,000 tons to near 90,000 tons at year end. Yet, as early as November 20, under the law, CPA ordered the Office of Metal Reserves to terminate foreign purchases subject to fulfillment of committments. This immediately affected copper imports. Since consumption held firm, naturally OMR's stock pile dwindled.

Today's best estimates are that not more than 9,000 tons of duty-free copper will be available for allocation this month. Thus, real hardship cases only can be considered. The pinch is on. Immediate action is necessary to avert a crisis. This indicates shortsightedness.

The problem also involves the battle of the 4-cent per pound duty. The fabricators hope the duty will be removed. Long ago, most producers approved this *on a temporary basis.* Rep. James T. Patterson, Waterbury's Congressman, has introduced legislation proposing that duty-free imports be allowed until domestic consumption and production attain a reasonable ratio.

However, politics being politics, Congress can't act quickly. Meanwhile, duty-free copper imports will be practically non-existent. Thus, the copper shortage appears due somewhat to politics as well as shortsightedness.

What's the answer? The President could halve the duty. This authority, held to be his under the reciprocal trade agreement act, was used during the extreme lumber shortage to further the housing program. This would not solve the problem; but it would help. Congress could then thrash out the whole problem in the light of supply and demand.

What is vital is that it be done now. The electrical industry must not lose production because of copper shortages. Especially is this true when shortsightedness and political expediency are the prevailing causes. Equipment delivery dates already are too long. What is needed is more copper. It can not be obtained by shortsightedness and politics. It can be obtained by considered, immediate federal action. The time is now.

★ ★ NEWS OF THE

End of Federal Transmission Systems in Southwest Sought

Sen. Moore of Oklahoma Proposes That SPA Be Denied Further Appropriations and That 9 Private Utilities Be Permitted to Buy Its Lines and All Federal Power Generated in Area

A PLAN to end federal construction and operation of power transmission systems in the Southwest is gaining strong support in Congress.

The proposal was advanced by Sen. Edward H. Moore, Oklahoma Republican, at a hearing of the House Subcommittee on Interior Department Appropriations this week. Senator Moore subsequently conferred with Sen. Styles Bridges and Rep. John Taber, chairmen of the two appropriations committees, and other Republican leaders.

Described by its author as readily applicable to other areas where the federal government has, or is contemplating, a substantial investment in power systems, the Moore plan has the twofold objective of (1) abolishing the Southwestern Power Administration and (2) turning over the marketing of energy developed at federal hydroelectric plants to private utilities.

First step in this procedure, Senator Moore told the House subcommittee, would be to eliminate all funds for SPA in the Interior Department Appropriation Bill for 1948, thus terminating financial support of the agency at the end of the current fiscal year on June 30. If this action is approved by the Congress, the Oklahoma legislator proposes to introduce legislation "to authorize and direct" the Secretary of Interior to negotiate with Southwestern utilities for their purchase of all energy from "existing and future" federal hydro plants of the area, their acquisition of SPA transmission facilities, and their construction of such other lines as required to "assure the most widespread use" of federal power and to integrate the government's plants.

Senator Moore's statement was accompanied by a letter signed by the presidents of nine Southwest utilities and dated February 15, 1947. This letter repeated the offer made twice last year by companies of the area to purchase all the energy marketed by SPA and, in addition, proposed to take over any obligations for transmission facilities entered into by SPA. Also, three companies—Oklahoma Gas & Electric Co., Arkansas Power & Light Co., and Southwestern Gas & Electric Co.—reiterated their offer to purchase from the Ark-La Electric Cooperative the Ark-La transmission line for an amount sufficient to "reimburse the federal government" for the loan the co-op received to build the line.

Signers of the letter, which Senator Moore said he requested, were R. K. Lane, Public Service Co. of Oklahoma; George A. Davis, Oklahoma Gas & Electric Co.; J. C. Happenny, Oklahoma Power & Water Co.; Frank M. Wilkes, Southwestern Gas & Electric Co.; C. H. Moses, Arkansas Power & Light Co.; James Hill, Jr., Arkansas-Missouri Power Corp.; Charles R. Preston, Kansas Gas & Electric Co.; D. C. McKee, Empire District Electric Co.; and H. H. Newman, Missouri Utilities Co.

This response, Senator Moore said, proved that the companies were "ready, willing, and able to enter into firm contracts" for the following purposes:

1. To purchase at the damsite all the hydroelectric output generated at the dams already constructed or to be constructed in the service area of any or all of the companies, at rates to be fixed by the Federal Power Commission as provided by law.

2. To purchase, individually, all existing SPA transmission lines constructed by the SPA within the territory served by the companies concerned.

3. To take over and assume any contract for transmission lines now under construction.

Would Assume SPA Contracts

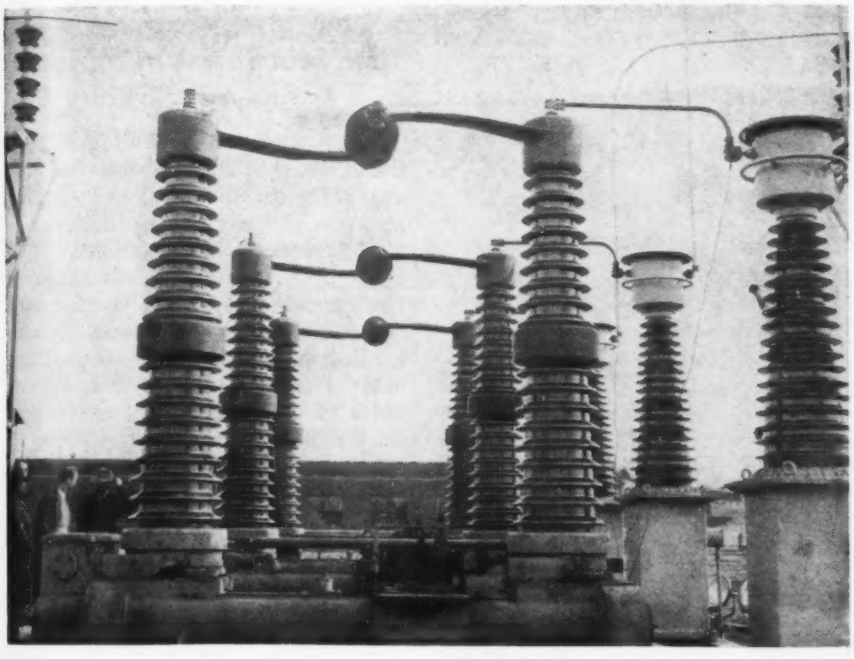
4. To assume any and all obligations under any contract entered into (by SPA) prior to February 15, 1947, for the construction of transmission lines or related facilities.

5. In addition—three of the companies have heretofore submitted an offer—to buy the transmission line from Markham Ferry, Okla., to Lake Catherine—for the approximate sum of $3,600,000, but not less than the amount necessary to fully reimburse the federal government.

6. To dispose of such power and energy in such manner as to encourage the more widespread use thereof at the lowest possible rate to consumers consistent with sound business principles, subject to the preference rights of public bodies and cooperatives, as provided by Section 5 of the Flood Control Act (1944), and subject to the orders, rules and regulations of any state regulatory body having jurisdiction.

At present, Senator Moore foresees no necessity for alerting any provisions of the 1944 Act. The Secretary of Interior, he pointed out, might continue primarily responsible for the marketing of power from Federal Flood Control projects but, at the direction of Congress, would deal directly with

DEDICATION—From the deck of the wrecked tanker, *S. S. Donbass III*, James S. Moulton, right, executive engineer of the Pacific Gas & Electric Co., broadcasts his dedicatory address as the tanker's 6,700-hp. power plant is tied into the lines of the utility at Eureka, Calif.



READY FOR THE TEST—General view of 220-kv. German circuit breaker which was tested last week end at BPA's J. D. Ross substation. In this picture, the breaker is closed. Current transformers at right are not part of breaker

private utilities of the area instead of through SPA. The preference clause of the act would remain unchanged, he indicated.

The Oklahoman's plea that SPA appropriations be discontinued, in order that "this useless and unnecessary agency may be terminated," is expected to appeal to Republican fiscal planners, who already have unofficially advised Washington newsmen that they planned to cut SPA appropriations for 1948 to the bone.

Edison Stamp Popular

A record was set February 11, when stamp collectors submitted 632,473 special letters or covers for first day cancellation of the new Thomas A. Edison commemorative stamp, placed on sale at Milan, Ohio, birthplace of the inventor. The old record was 585,565 for the 3-cent World's Fair stamp of 1939. Total first-day sales of the Edison stamp were 1,263,439.

Sachse May Leave FPC, Has Been in Poor Health

Richard Sachse, vice-chairman of the Federal Power Commission, refused early this week to confirm or deny reports of his imminent retirement from the commission.

He told an ELECTRICAL WORLD representative that he had not, as yet, tendered his resignation to President Truman. Whether or not he would do so later, he added, depended upon the state of his health and the advice of his physician.

Commissioner Sachse was taken ill on January 18 when he suffered what his doctors described as a "slight stroke." His condition has been reported as steadily improving in the last few weeks, however, and he has undertaken some of his duties as a member of the commission.

•

More Power for TVA

The Tennessee Valley Authority will double the capacity of its Fort Loudoun hydro plant, Lenoir City, Tenn., by installing two 32,000-kw. units.

German Breaker in Tests Performs Satisfactorily

Final Determination of Operating Characteristics Awaits Analysis of Oscillograms and Other Data

Thirty tests made over last week end on a 220-kv., 2,500-mva., AEG (German), free-stream, air-blast circuit breaker gave results that in general were satisfactory and in accordance with the breaker's expected performance. Final determination of the breaker's precise operating characteristics and possibilities must await analysis of the oscillograms taken on each test and on other data.

The tests were made at the J. D. Ross substation of the Bonneville Power Administration near Vancouver, Wash. Over 50 engineers from manufacturing companies, electric utilities, government bodies, and universities observed them. The observers were in almost unanimous agreement that the breaker has possibilities because of its air-blast features, simplicity from a maintenance standpoint, and selectivity as to single-phase interrupting.

Alexander Dovjikov, Chief of Analysis and Research Division of Branch of Engineering and Operation, BPA, said everyone was impressed by the ease of inspection and maintenance of the breaker because of the absence of the use of oil, an important factor to operating men.

Breaker Requires Improvement

"The breaker as is was found not entirely suitable," he said, "for opening long distance lines, as was indicated by the re-strikes occurring in the line charging current interrupting tests, but hope was expressed that this limitation may be overcome by improvement of certain features of design.

"Among desired improvements would be to speed up opening the fault to reduce the five and one-half cycle operation to the normally accepted and used three-cycle opening."

Three types of tests were conducted: Three-phase and single-phase fault current interrupting tests with loads of from 500 to 2,300-mva. with full opening of breaker arms; reclosing tests against arcing faults with reclosing in from 11 to 23 cycles, also on loads up to 2,300 mva.; and switching tests to

energize and deenergize lines 71 and 169 miles long.

The breaker opened solid and arc faults in from five and one-half to six cycles of which two to three cycles was arcing time. Different pressures of air blast from 280 to 300 psi. were tried with the higher pressures giving the best apparent results. Reclosing time from initiating the trip coils on the first break until the contacts reclosed was 11, 18, or 23 cycles depending on the setting.

In the tests interrupting line charging currents, re-strikes occurred that threw high-voltage surges on the system.

During the 31 hours of testing an unusually heavy duty was placed on the breaker. It stood up surprisingly well, requiring no maintenance. The copper contacts were changed once in 90 minutes.

Byproduct tests were conducted at the same time, including fault current measuring, fault locating, and experiments on the interrupting ability of a 115-kv. fuse on the 230-kv. circuit giving 132 kv. to ground on a single phase. Sweitzer & Conrad 115-kv., 30- and 40-amp. fuses were used. Two fuses in series cleared a single-phase to ground fault under a 2,300-mva. load in from two to three cycles.

•

December Peak Loads Hit New High, FPC Reports

Major electric utility system peak loads of December, 1946, set an all-time record high of 43,173,808 kw., according to figures released by the Federal Power Commission. December peak loads, totaling 14.0 percent higher than December, 1945, exceeded by a substantial margin the largest previous peak load aggregate of 41,934,844 kw. in November, 1946.

Extremely rapid post-war recovery and increase of loads on electric systems is reflected in the fact that peak loads have not only increased over pre-war levels; but have outrun the highest loads of the war years. December peaks in the pre-war year 1940 were about 28,000,000 kw. During the war years the record high was 38,252,630 kw. in January, 1945. The December, 1946, figure exceeds the 1940 figure by almost 55 percent and the war-time high by 12.9 percent.

Corresponding energy requirements for December amounted to 20,432,207,000 kw.-hr., also a record maximum, and a gain of 14.4 percent over December, 1945, but only 1.8 percent gain over the 20,075,056,000 kw.-hr. record of January, 1945.

Karl Compton Receives 1947 Washington Award

For his scientific and engineering activities which have contributed considerably to the happiness, comfort, and well being of humanity, Dr. Karl T. Compton received the Washington Award of the Western Society of Engineers Wednesday, at ceremonies at Chicago.

The award is given each year on the

recommendation of the American Society of Civil Engineers, American Institute of Electrical Engineers, American Society of Mechanical Engineers, American Institute of Mining and Metallurgical Engineers, and the Western Society of Engineers. Dr. Vannevar Bush received the award in 1946, and Dr. Compton's brother Arthur received the award in 1945.

As president of Massachusetts Institute of Technology, Dr. Compton's contributions in the field of administration include notable developments in the program of scientific and engineering education and fundamental research. He has long supported measures which encourage individual development and free enterprise and has been particularly active in directing attention to the important contributions that modern physics has made and has advocated the expansion of industrial research as a means of maintaining and improving the American standard of living.

•

Merger Rehearing Denied

The Federal Power Commission has denied an application for rehearing of its recent order authorizing the merger of the Northwestern Electric Co. with Pacific Power & Light Co. The application was filed by Interstate Electric, Inc., Washington State Public Utility Commissioners Association, Washington State Grange, and Walla Walla Electric Cooperative.

The commission's denial of rehearing stated that no new facts had been presented which would justify revision of the merger approval.

•

Rate Schedule A of SPA Given Approval by FPC

One of two rate schedules filed with the Federal Power Commission last summer by the Southwestern Power Administration has been approved.

The confirmed rates are in SPA's Schedule A. No action was taken by the commission on the controversial Schedule B, which was opposed by members of the Southwest power pool and held in abeyance by FPC at the request of SPA Administrator Douglas G. Wright.

Schedule A is applicable to "any customer purchasing power in wholesale quantities for firm power service who contracts with the Administrator for a specified number of kilowatts." It provides a demand charge of $1.35 per month per kw. of billing demand, which includes the use of 200 kw.-hr. per kilowatt, and an energy charge of four mills per kw.-hr. for additional energy used.

FPC's approval was granted on an interim basis and subject to review and revision, if deemed necessary by the commission within six years.

Administer Wright requested FPC to delay approval of Schedule B after failing to obtain appropriations during the last session of Congress for fuel-burning generating plants. These rates would have established a monthly demand charge of $1.75 per kw. of billing demand and an energy charge of 1.75 mills per kw.-hr. for all energy in excess of 300 kw.-hr. per month to customers purchasing 75 percent or more of their entire power requirements from SPA.

This schedule was termed discriminatory by power pool members, who pointed out that they could qualify for its cheaper rates only by taking at least 75 percent of their energy requirements from SPA. It would be impossible for SPA to supply them anywhere near so much energy, they contended.

•

Will Add 15,000-Kw. Unit

Southwestern Public Service Co. will double the capacity of its plant at Carlsbad, N. M., by installing a 15,000-kw. unit.

Unit Substations Main Topic of P.E.A. Committee Meetings

Discussers Stress Part Such Equipment Will Play in Aiding Utility Systems Meet Mounting Loads—Standardization of Design Dimensions Urged to Permit Parts Interchangeability

UNIT SUBSTATIONS clearly dominated joint sessions of the Pennsylvania Electric Association's Transmission and Distribution and Electrical Equipment Committees at Harrisburg last week.

Discussers universally emphasized the part that unit substations will play in expanding utility systems to meet mounting loads. Many utility engineers urged standardization of design dimensions among manufacturers to permit interchangeability of components and to cut down investment in spare equipments. Also sounded was a warning that standardization must consider the convenience of maintenance.

Characteristics of unit substations sold during the past 15 years, outlined by R. L. Witzke, Westinghouse Electric Corp., reveal the most popular size to be 3,000 kva. with 1,500-, 2,000-, and 2,500-kva. sizes widely used. Nearly 60 percent of units sold by Westinghouse operate on primary voltages in the 11- to 14.4-kv. range and 56.5 percent are in network service, Witzke disclosed. Where tap changing under load equipment is supplied, 53.6 percent called for a range of plus or minus 7½ percent. Secondary feeder rating in 57 percent of the cases fall between 501 and 1,000 kva.

Since 1937, 70 unit substations have been placed in operation on the Philadelphia Electric Co. system and at the beginning of this year, 54 additional units were on hand or on order for installation in 1947 and 1948, C. E. Nelson reported. Average loading of the units in service was 100.4 percent of nameplate rating at the time of 1946 system peak, he revealed. Of the units now on order for the Philadelphia system one is rated 30,000 kva. and comprises two 15,000-kva., 66/13-kv. transformers serving five outgoing feeders, B. R. Nevins disclosed.

During the 400 unit-years of experience accumulated by Philadelphia Electric with the 49 unit substations in suburban service, only five cases of trouble have resulted in unit losses, H. MacVaugh, Jr. reported. In the same period 81 cases of minor trouble were encountered, but none necessitated taking a unit out of service. Experience with the 21 units in urban service was characterized as "interruption free," by R. T. Brotzman.

H. P. Sleeper, Public Service Electric & Gas Co., Newark, urged standardization of units with convenience of maintenance in mind. Much maintenance on unit substations must be done out of doors, he pointed out. Interchangeability of equipments among makes would permit replacement of units needing maintenance with an accompanying improvement in the convenience and cost of maintenance. R. E. Neidig, Metropolitan Edison Co., suggested interchangeability of transformer units not only among makes but over a range of sizes so that several transformer capacities could be used with the same switchgear units.

Extension of the "hot stick" technique to station maintenance was asked by E. W. Oesterreich, Duquesne Light Co. Otherwise, the present period of rapid load increase and heavy equipment loadings offers only two alternatives, he warned: (1) Let necessary maintenance go undone. (2) Accept an increase in service outages to permit maintenance of equipment. Mr. Oesterreich's remarks preceded the showing of a film portraying use of the hot stick technique for removal of a 22-kv. air break switch from service for inspection.

Half the recent changes in design of electrical equipments are due to availability of new materials that came out of the war. This was asserted by R. C. Bergvall, Westinghouse, in a talk to the Electrical Equipment Committee.

Despite efforts to standardize on a limited number of new materials, the Westinghouse list has doubled and keeps growing as new substances offer opportunity for improvement of products. Silicones are finding new uses (such as dashpot oils, enclosed-motor ball-bearing greases, hot gaskets), but use as insulation has only recently overridden impediments such as need for commensurate slot liners and wedges.

Splicing adhesives and techniques need to be developed for certain insoluble plastics. Fosterite falls intermediate in characteristics and serviceability between the common varnishes and the silicones. A good synthetic mica is greatly needed, and Bergvall

COMMITTEE OFFICERS—Chairmen of Pennsylvania Electric Association technical committees at Harrisburg meeting. Left to right are B. M. Jones, Duquesne Light Co., chairman, Engineering Section; J. S. Brown, Duquesne Light, chairman, Electrical Equipment Committee; C. C. Farrell, Philadelphia Electric Co., chairman, Transmission & Distribution Committee; R. E. Neidig, Metropolitan Edison Co., vice-chairman, Electrical Equipment Committee; K. A. Cotton, Pennsylvania Power Co., vice-chairman, T. & D. Committee; and W. H. Jones, Philadelphia Electric Co., vice-chairman, Engineering Section

suggested that the Army could well sponsor the development. Titanium alloys are being found appropriate for gas turbine blade forgings; they have the anomalous behavior of annealing when quenched and of hardening when "annealed."

•

Krug Mollifies Stockman; Attack on Raver Ceases

Interior Secretary Julius Krug's assurance that his department will cooperate with the House Subcommittee on Interior Appropriations has apparently mollified Rep. Lowell Stockman, who had demanded the resignation of Paul J. Raver, Bonneville Power Administrator, for lack of cooperation (ELECTRICAL WORLD, February 22, Page 6).

In Washington, the Oregon Republican commented that he had never had any doubts as to Dr. Raver's "ability as an administrator." But Secretary Krug's personal interest in the work of the Interior subcommittee, particularly in reference to BPA, should be a "big help," he added.

•

Argonne Laboratory Will Move to Site near Chicago

Argonne National Laboratory, the war-time metallurgical laboratory at the University of Chicago which helped create the atom bomb, will be moved to a site 26 miles southwest of Chicago where laboratories will be built on a 3,645-acre site with federal funds.

The site has been approved by the Atomic Energy Commission, and the project will be operated by the University of Chicago and 24 other Midwestern Universities.

Lilienthal Hearings Near Close; Senate Fight Next

Senate committee hearings on the nomination of David E. Lilienthal to be Atomic Energy Commission chairman drew to a close this week with Sen. Kenneth McKellar still trying to prove the former TVA chairman has Communist leanings.

The committee expected at mid-week to wind up public hearings, which began five weeks ago, with a final rebuttal statement by the nominee. Senate Republican Leader Robert A. Taft, who has announced his own opposition to Lilienthal, said the floor fight would start next week. All signs point toward eventual Senate confirmation barring some unforeseen last-minute upset.

At the same time the Senate Public Works Committee tentatively closed five weeks of public hearings on the nomination of Gordon R. Clapp to succeed Lilienthal as chairman of the Board of TVA. Committee Chairman Chapman Revercomb indicated the committee wouldn't send the Clapp nomination to the floor, however, for another week or two. Clapp's confirmation likewise seems probable. Clapp was offered a chance to make a final statement last Tuesday but said he was willing to let the record of the last five weeks speak for itself.

S. R. Finley, general superintendent of the Electric Power Board of Chattanooga, Tenn., which is one of the biggest municipal users of TVA power, was one of Lilienthal's last witnesses. He said,

"I have found him to exhibit the qualities of a most able administrator, a sincere public servant and thoroughly alive to his public responsibilities as an official of the United States Government.

"If I had the responsibility of selecting the chairman of the Atomic Energy Commission I know of no other person whom I would rather see in this position than David E. Lilienthal."

Senator Vandenberg read into the record a telegram from Owen D. Young, former General Electric Co. executive, as follows:

"Because of my interest in public utilities I became acquainted with David Lilienthal nearly 20 years ago. I regarded him as an adversary and so naturally watched him with a critical eye. Because of my interest in the international problems of this nation, I have also watched Lilienthal's work in the atomic field. As a result, I wish to say that he is a man of clear vision, of executive ability, of firmness and unquestionable loyalty and in a unique position to serve effectively in the position for which the President has nominated him."

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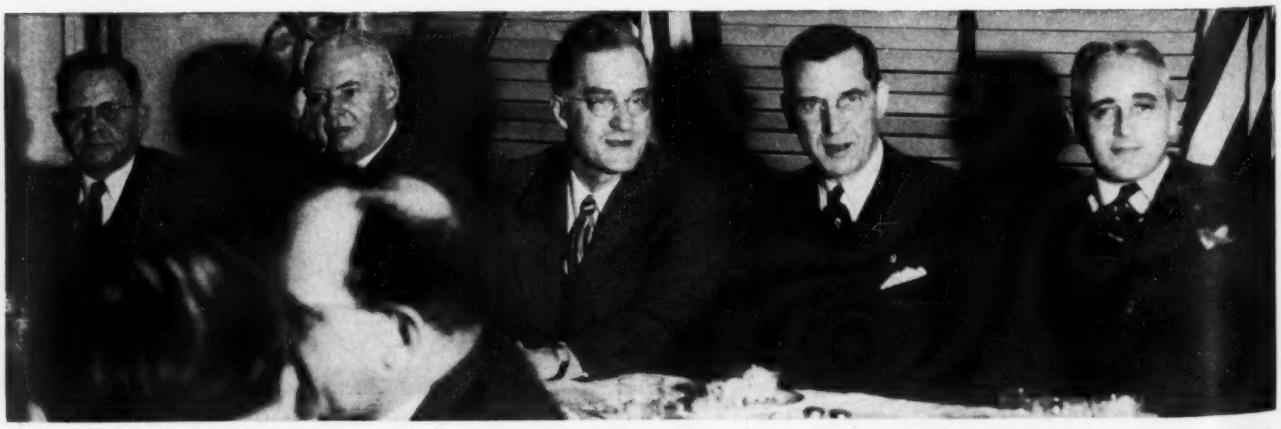
Expansion of Co-op Halted

California Electric Power Co. recently won a decision over REA-backed Mesa Electric Cooperative, Inc., when the California Public Utilities Commission issued a "cease and desist" order stopping the co-op's program to bring power to Victorville, Calif. The case was the first to test state control of REA-chartered cooperatives in California.

Contending its main lines go through the area concerned and that plans are completed to develop it soon, the company had asked that the commission take jurisdiction over the cooperative.

The commission's order instructed the co-op to stop operation and construction until it gets a certificate of public convenience and necessity to continue the program.



HONORING EDISON IN VERMONT—At the Edison Centennial dinner at Burlington, Vt., on February 11, those at the head table were C. R. Benton, left, who worked for Edison as a draftsman from 1900 to 1903; Clarence A. Forrest, president of the Vermont Electrical Association; Dr. Karl B. McEachron, assistant works engineer, General Electric Co., Pittsfield, Mass.; Albert A. Cree, president of Central Vermont Public Service Corp.; and Ernest W. Gibson, Governor of Vermont

Investment of Government In 3 Nebraska P.P.D.'s Safe

General Counsel of FWA Says New Financing to Build Steam Plant Improves Value of Old Securities

The federal government's $43,000,000 investment in properties of three Nebraska public power districts is "amply protected" by the districts' financial arrangements for construction of a 60,000-kw. steam generating plant at Bellevue on the Missouri River, according to General Counsel Alan Johnstone of the Federal Works Agency.

"As a matter of fact," Mr. Johnstone added, "the status of the power district bonds held by the government has been vastly improved by the deal since completion of the plant will provide the districts with increased revenues with which to retire these bonds."

Johnstone's statement followed stories in the daily press which attacked the honesty of FWA in approving the sale of bonds to finance construction of the station. However, the plans of the districts had been reviewed in advance by FWA, as custodians of the government's bonds, and had been approved.

The districts involved are the Platte Valley Public Power & Irrigation District, Loup River Public Power District, and Central Nebraska Public Power & Irrigation District. All will own an interest in new plant which will be operated under the management of all three.

First Assistance in 1936

Government assistance to the districts began in 1936 when the federal government bought $43,000,000 in bonds to finance their hydro generating and distribution operations and irrigation projects. The districts market their energy through the Nebraska Public Power System, a combined sales agency, which recently signed a ten-year contract with the Omaha Public Power District under which the system will sell Omaha power during the irrigation season and will buy from Omaha at other seasons in order to increase its water storage. Nebraska Public Power also operates and sells energy from steam plants owned by Consumers Public Power District, a group of municipal distribution systems.

When it became apparent in 1946 that the districts required more power, Mr. Johnstone said, "the sensible course seemed to be to permit the people of Nebraska to build the new plant, to pool its revenues with other revenues of the hydros, to meet the charges of the steam plant out of this pool, and to make available the resulting increased yields for the retirement of the government's bonds. A conservative estimate of the value of the increased output is that it would produce annual revenues amounting to $500,000 more than is required to service the steam plant bonds."

MONEY FOR A STEAM PLANT—Gerard Ives, left, second vice-president of the Guaranty Trust Co., New York, hands a check for $10,000,000 to Claude B. Miller, president of the National Nebraska Public Power & Irrigation District. Standing are Roy Homer, left, vice-president of Platte Valley Public Power & Irrigation District, and Edd Kelly, president of Loup River Public Power District. The loan will finance construction of a 60,000-kw. steam plant at Bellevue, Neb.

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G. E. Workers at Tiffin, O., Vote 2 Unions as Agents

Shop employees of the General Electric Co. at Tiffin, Ohio, have elected the United Electrical, Radio & Machine Workers, C.I.O., and the Mechanics Educational Society of America, independent, as their bargaining agents, according to a certification by the National Labor Relations Board.

The C.I.O. union will represent some 640 production workers and the M.E. S.A. 122 employees in the maintenance department and tool and die room and all die setters.

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Expansion Continues

Duke Power Co., which now is increasing the capacity of its Cliffside plant from 80,000 to 145,000 kw., has announced that it will continue expanding the plant to a capacity of 210,000 kw. The first additional unit is to be in operation within a short time. The plant is on Broad River, near Shelby, N. C.

Bill to End Utility Strikes Proposed in Indiana House

Legislation to prevent strikes of utility employees has been introduced in the Indiana General Assembly by Rep. George J. Edick, Plainfield Republican.

The bill provides for appointment by the governor of a panel of ten conciliators and 30 arbitrators. All would be residents of the state, would be appointed non-politically, and would be paid only for service.

After collective bargaining had failed to bring a settlement between a public utility and its employees, either party might petition the governor to appoint a conciliator from the panel.

If a strike or lockout be likely to halt service, the governor would appoint a conciliator; then all strikes and lockouts would be barred until all remedies provided by the bill be exhausted.

The conciliator would have 30 days to effect a settlement. Should he fail, he would report to the governor who, if he still believed an interruption of service likely, would appoint a board of three arbitrators from the panel of 30. Each party to the dispute could appoint one voteless representative to sit with the board. A majority vote of the board would make any order binding.

Any decision affecting wages or working conditions would be based on prevailing wages and conditions in sim-

ilar utilities in the same labor area, or if there be none, in adjoining areas in Indiana. If there be a contract between the disputing parties, the board shall be limited to interpreting the contract and its application. No wage clauses could be retroactive to a date preceding termination of any contract previously in force.

Any board order would be effective for one year after its filing with the clerk of a circuit court. Within 15 days of filing, either party could petition the circuit court for review. A circuit judge, without jury, would hear the case. His decision would be final. If the order be reversed, the governor is notified and may attempt further conciliation or appoint another board of arbitration.

Violation of the law would be punishable by fine of $500 to $2,500 and by six months in the county jail.

Employees would not be forced to work under the provisions of the act, but they could not act in concert to cause a work slowdown or stoppage.

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Blackburn Scores Defects of Industrial Power Sales

"Aggravating and irritating terms and conditions" in power contracts were cited by L. A. Blackburn, Richmond, Va., consulting engineer, at the meeting of the Interstate Power Club, February 24 in New York, as one of the things wrong in the industrial power sales picture. Some complexities have been removed from industrial rate schedules, he said, but too many still remain; and few customers understand why they are required to pay for service in the ways that rate schedules impose.

Another point made by Mr. Blackburn was that the average power salesman is not sufficiently well informed on the customer's problems, and at the same time is so sure that he is informed that he has his mind closed against complete understanding of them.

Plastics was the subject of two speakers, W. A. Dew, E. I. du Pont de Nemours & Co., and Charles Landsheft, Boonton (N. J.) Moulding Co., in talks that turned out to be complementary. Dr. Dew told of the research from which has resulted the synthetic materials already known and which promises others in the future. Mr. Landsheft, using a motion picture, described the production methods and processes by which plastics are shaped into commercial forms. A new technicolor film showing latest developments in induction and dielectric heating was exhibited at the meeting by Albert Valente, Westinghouse Electric Corp.

SPA Speeds Construction to Use All Appropriations

Southwestern Power Administration has sharply accelerated its construction program to get as much work as possible under way before the end of the current fiscal year. Contracts for two links of the transmission lines to interconnect the Norfork and Denison hydroelectric plants already have been awarded, and bids for construction of several others are to be let within the next month, Administrator Douglas G. Wright advised.

Present construction is financed by a $7,500,000-fund appropriated by Congress last summer. Any portion of this sum uncommitted by June 30 will be lost to SPA unless Congress reauthorizes expenditure of the balance, a possibility which now appears remote.

Administrator Wright announced last week the award, subject to Interior Department approval, of a $819,775 bid for erection of a 60-mile, 154-kv. transmission line from the Norfork plant in Central Arkansas to Witts Springs, Ark. Successful bidder was the Donovan Construction Co. of St. Paul. Three weeks previously SPA awarded a contract to the Elliot Construction Co. of Omaha to build 20 miles of 132-kv. line from Denison plant in northern Texas to Brown, Okla. No other major construction contracts have been let by SPA during this fiscal year.

Other transmission line contracts scheduled for early award include 50 miles of 154-kv. lines between Alma and Clarksville, Ark., to be let on March 5; the Brown to Ada, Ark., 132-kv. line and the 154-kv. link from Clarksville to Witts Springs, both to be let about March 15.

SEC RULINGS

The Securities and Exchange Commission recently issued a series of orders affecting electric utility companies.

American Water Works & Electric Co.'s plan of recapitalization has been approved by the commission as now modified to conform to suggestions made by the agency in its opinion of December 23, 1946. The plan is part of a program that eventually will result in dissolution of the company and transfer of substantially all its water properties to a new company, the Water Works Holding Co. American Water original plan was amended to provide increased payments to holders of preferred shares of the Community Water Service Co. and the Ohio Cities Water Corp. The commission rejected the original plan last December 23 after American Water Works offered $135 and $120 a share, respectively, to Community and Ohio Cities preferred stockholders. As approved the plan provides for payment in cash or its equivalent in common stock of Water Works Holding of $180 a share on outstanding preferred stock of Community and $159 a share on Ohio Cities. Community's common stockholders would receive one share of the new common stock of Water Works Holding for each 20 shares of Community held. The amended plan also provides for a $2,200,000 escrow fund to cover redemption premiums of preferred stock of American Water Works. (Release No. 7208).

Electric Bond & Share Co.'s application for permission to sell to 13 banks $30,000,000 of 1¾ percent notes maturing in two years, has been approved. The company will use the money, together with cash realized from the sale of common stocks of the American Gas & Electric Co. and the Pennsylvania Power & Light Co., to pay $70 a share to Electric Bond preferred stockholders. (Release No. 7210).

MEETINGS

Previously Listed

American Society of Mechanical Engineers—Spring meeting, Mayo Hotel, Tulsa, Okla., March 2-5.

National Electrical Manufacturers Association—Spring meeting, Edgewater Beach Hotel, Chicago, March 3-5.

Canadian Electrical Association—Western conference, Hotel Vancouver, Vancouver, B. C., March 3-5.

Institute of Radio Engineers—National Convention, Hotel Commodore, New York, March 3-6.

Radio Engineering Show—Grand Central Palace, New York, March 3-6.

Rural Electrical Contractors Association—Annual Convention, Roosevelt Hotel, New Orleans, March 13-15.

Oklahoma Utilities Association—Annual convention, Tulsa Hotel, Tulsa, Okla., March 20-21.

Southeastern Electric Exchange—Spring conference of the Engineering and Operation Section, Sheraton Bon Air Hotel, Augusta, Ga., March 20-21.

Midwest Power Conference—Palmer House, Chicago, March 31-April 2.

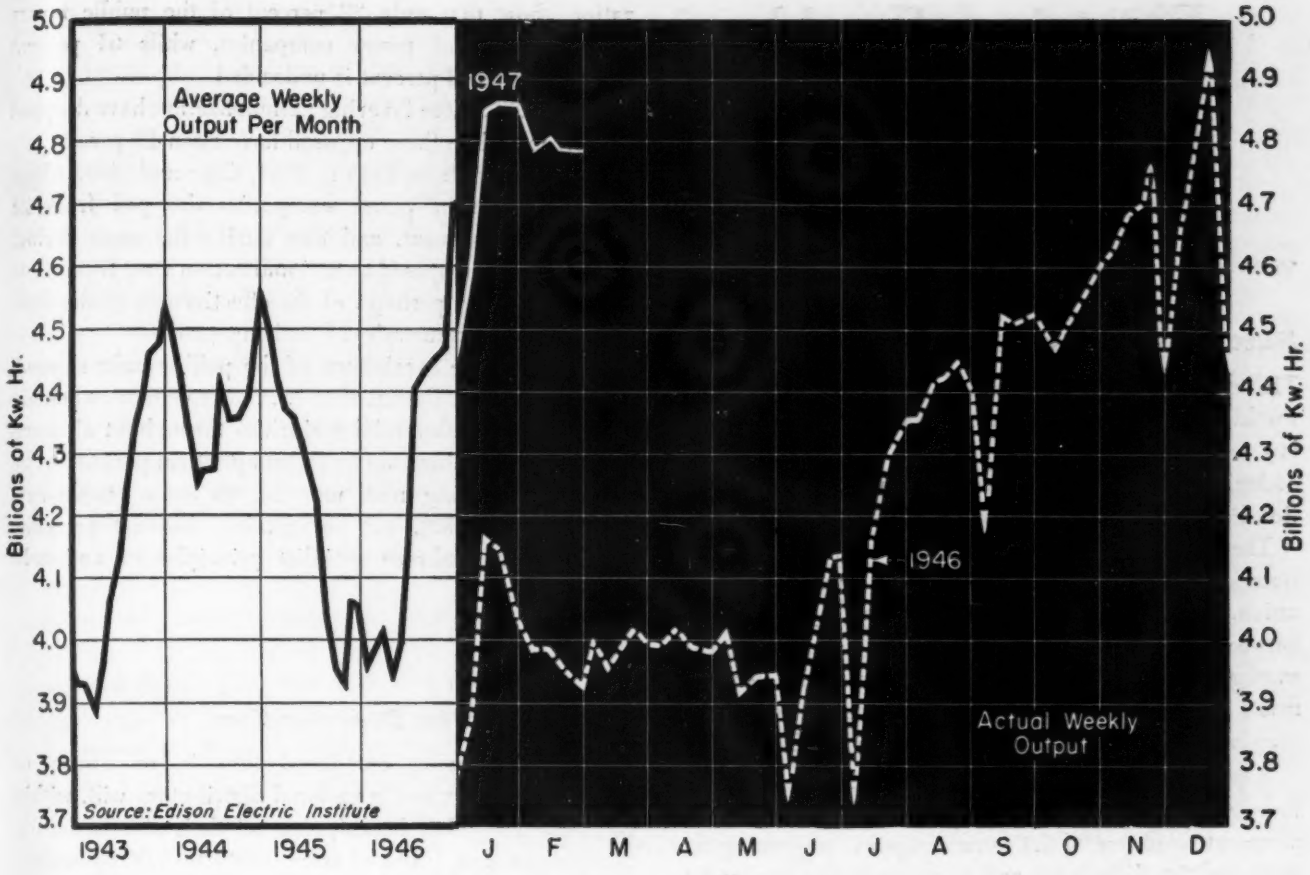
Edison Electric Institute—Annual Sales Conference, Edgewater Beach Hotel, Chicago, March 31-April 3.

Southeastern Electric Exchange—Annual Conference, Vinoy Park Hotel, St. Petersburg, Fla., April 3-5; Home Service Conference, Thomas Jefferson Hotel, Birmingham, Ala., May 13-14.

National Association of Corrosion Engineers—Annual Conference and Exhibition, Palmer House, Chicago, April 7-10.

Northwest Electric Light & Power Association—Engineering and Operation Section, Multnomah Hotel, Portland, Ore., April 9-11; Business Development Section, Olympic Hotel, Seattle, Wash., May 7-9.

Electrochemical Society—Spring Congress, Hotel Brown, Louisville, Ky., April 9-12.



Iowa Cooperative Granted REA Loan to Build Plant

Additional funds totaling $1,300,000 have been loaned by the Rural Electrification Administration to the Southwestern Federated Cooperative, Inc., to complete a generating plant near Creston, Iowa.

The co-op received a $675,000 REA loan in October, 1945, to erect a 2,200-kw. plant which would supply energy for two distribution cooperatives. Under terms of the new loan these plans have been changed to provide a 5,500-kw. plant to serve four co-ops initially and another eventually.

A proposal was abandoned to install steam generators. The co-op has decided to employ dual-fuel diesel engines and to take advantage of natural gas supplies now available in the region. Present plans call for construction of 175 miles of 34-kv. transmission lines, instead of the originally scheduled 70 miles of 69-kv. lines. Nine step-down substations also will be built. Preliminary construction work already has started, and the delivery of two 1,100-kw. generating units is expected early this spring.

Immediate power purchasers will be the Adams County Cooperative Electric Co., Farmers' Electric Cooperative, Inc., Clarke Electric Cooperative, Inc., and Rideta Electric Cooperative, Inc. These co-ops have been supplied with energy by two municipal plants and by Iowa Southern Utilities Co.

The fifth member of Southwestern Federated is the Nyman Electric Cooperative, Inc., which recently signed an exclusive contract for energy with the Iowa Power & Light Co. Because of this agreement, a co-op spokesman said, the Nyman cooperative cannot purchase power from the new organization "until some time in 1952."

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Rural Loans Approved

The Rural Electrification Administration in January approved loans totalling $15,479,500 to 49 cooperatives and one public power body in 24 states. Most of the loans were for the construction of lines, of which 7,726 miles are to be built to serve 21,544 customers.

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Don't Want Hydro Plant

Acquisition of the 335-hp. plant of the Wisconsin Hydro Electric Co. by the town of Chetek was recently defeated in a referendum of the citizens, 194 to 71, with less than a third of the citizens voting.

Electric Output Holds Firm

A change that was hardly perceptible occurred in the electric output curve during the week ended February 22, 1947, according to figures released by the Edison Electric Institute.

The amount of electrical energy distributed by the light and power industry during the week amounted to 4,777,740,000 kw.-hr., comparing with 4,778,234,000 kw.-hr. during the preceding week. During the week ended February 23, 1946, the amount of electrical energy distributed totaled 3,922,796,000 kw.-hr., this year's figure representing an increase of 21.8 percent.

Weekly Output, Millions Kw.-Hr.

1947		1946		1945	
Feb. 22	4,778	Feb. 23	3,923	Feb. 24	4,474
Feb. 15	4,778	Feb. 16	3,949	Feb. 17	4,472
Feb. 8	4,801	Feb. 9	3,983	Feb. 10	4,505
Feb. 1	4,777	Feb. 2	3,983	Feb. 3	4,539
Jan. 25	4,856	Jan. 26	4,034	Jan. 27	4,577
Jan. 18	4,857	Jan. 19	4,145	Jan. 20	4,588
Jan. 11	4,853	Jan. 12	4,163	Jan. 13	4,614
Jan. 4	4,574	Jan. 5	3,865	Jan. 6	4,427
1946		1945		1944	
Dec. 28	4,442	Dec. 29	3,759	Dec. 30	4,226
Dec. 21	4,940	Dec. 22	4,239	Dec. 23	4,617
Dec. 14	4,778	Dec. 15	4,154	Dec. 16	4,563
Dec. 7	4,673	Dec. 8	4,097	Dec. 9	4,538

Percent Change from Previous Year

	Feb. 22	Feb. 15	Feb. 8
New England	+16.4	+12.8	+12.6
Mid-Atlantic	+14.3	+13.6	+12.4
Central Industrial	+30.8	+29.3	+30.3
West Central	+17.0	+16.7	+14.7
Southern States	+23.5	+24.1	+22.5
Rocky Mountain	+ 7.6	+ 7.0	+ 8.0
Pacific Coast	+19.9	+19.4	+19.1
Total United States	+21.8	+21.0	+20.5

Electrical World OPINION

Pattern For Good Labor Relations

THE country's Number 1 problem is labor relations. Some would solve it by enacting laws. Much as some additional law is needed to curb certain union leaders, no amount of legislation will create good labor relations. The solution lies in creating good *employee* relations.

There is a vast difference between the two. Labor relations relates to the dealings between management and union. Employee relations concerns the myriad contacts between management and employees. It begins when the employee is interviewed for hiring, broadens when he meets his foreman, and operates effectively when he is convinced his company is treating him "right."

A power company lineman was injured seriously. His foreman telephoned the victim's wife, an engineering department employee of the same company, suggesting that she meet the ambulance and accompany her husband to the hospital. The wife's request for permission to go was refused; she had been given a day off earlier that week.

This was no problem in labor relations. No union was involved. It was a problem in employee relations. Certainly it was not the company's policy to refuse leave under such circumstances. Such situations must be handled properly if good employee relations are to develop.

The pattern for good labor relations is to develop such good employee relations that employees will not feel it necessary to seek union representation, or, if there be a union, that they will not support irresponsible or unwarranted union demands.

Developing good employee relations is not simple, but there are well-defined, reasonably precise principles which can be followed. Such a program requires managerial attention, skill, and know-how. It costs money. Still, isn't it better to develop them before the union takes over than afterwards, when the union attempts to capitalize on management moves of benefit to employees?

Nationalization Loses Ground

WHATEVER the public's viewpoint regarding federal participation in national electric power supply through the construction of hydroelectric projects, the public does not favor the nationalization of electric power.

This is unmistakable from the January 29 report of the American Institute of Public Opinion, headed by Dr. George Gallup. Results of a poll conducted by this organization show that only 28 percent of the public favors nationalization of power companies, while 64 percent opposes it, and 8 percent is undecided.

Since 1936, those favoring nationalization have dropped 12 percent, while those opposed have risen 12 percent.

The fact that from 1945 to 1947, those undecided about nationalization of power companies dropped from 21 percent to 8 percent, and that during the same period, the percentage opposed to nationalization rose from 50 to 64 is indicative, perhaps, of the effectiveness of the campaign by the industry's advertising group.

More intimate breakdown of the poll's results showed, according to Dr. Gallup, that ". . . government ownership is opposed by substantial majorities throughout all occupation groups, education levels and political parties." The American working man may be, as some people say, moving to the left, but he certainly has not yet gone so far as to embrace socialist principles of nationalization.

Electricity in Distribution

"I AM thoroughly convinced that in one form or another, most of the big national distributors will, within the next few years, be shipping all their standard commodities in unit loads of from 1,000 to 3,000 pounds."

This quote is from an address by John D. Sheahan to the recent Marketing Conference of the American Management Association. Unit load handling, he said, is made possible by the lift-truck-pallet combination.

Here is great opportunity for the electrical industry, its manufacturers and the suppliers of electricity. It is an opportunity to make a major contribution to one of the most stubborn problems of our economy, the cost of distribution. It is also an opportunity for profit.

The electric industrial truck inherently is a natural for pallet handling. In its batteries it has weight so disposed as most effectively to counterbalance the pallet load. It is safe, clean, economical, smooth and exact.

Mr. Sheahan added: "We are in a materials-handling revolution, as actual, and some ways as important, as that of the development of mass production line techniques. Those forward-looking companies who see this will be quick to seize and exploit a competitive opportunity such as may come only once in a generation."

No one needs to be reminded of the part electricity plays in production line operations. Without its power, so flexibly applied and so accurately controlled, mass production could barely exist. Will electricity figure equally in the developing techniques of mass distribution?

It will if the electrical industry retains today the same enterprise it had yesterday, when modern production lines were in the making. We don't believe those qualities are lacking in the industry today. Through the agencies of the industrial truck and of other electrical applications to goods handling, we confidently expect to see electricity playing a major role in the distribution of the future.

Power Consumption in a Recession

ENERGY SALES to industrial consumers are continuing at record peace-time levels, their total only 5 percent below the war-time peak. But business analysts suggest that industry prepare for some let-down later this year. None predicts a drastic decline—indeed most forecasts are for a dip accompanying price adjustments. If and when the anticipated dip occurs, it will bring reduced electricity consumption by industry.

Strongest element in the current business picture, most analysts stress, is the huge backlog of demand for consumer and business durable goods. Barring strikes, such output is expected to maintain current levels for many months. Eventual curtailment should not be great. This is particularly encouraging to electric utilities, since a Federal Power Commission report on industrial power shows the durable goods industries, including their raw material sources, to be among the heaviest industrial consumers of electricity.

Continued heavy production of durables has a further significance for electric utilities. Much of the output represents electrical appliances, whose sales are expected to continue even in the face of some decline in incomes.

Prospects for most machinery and equipment lines also offer encouragement to power industry. Higher wage rates, improved methods and accumulated obsolescence have left an extraordinary demand for new equipment. As new machinery is introduced, the kw.-hr. used per worker in industry and commerce must be increased. E.E.I. has estimated that already in 1946, kw.-hr. per man-hour in manufacturing rose to a new high of 4.78. Prior to the war, the high was 4.62 kw.-hr. per man-hour in 1940.

Any dip in business which might occur in 1947, then, may have a modest effect on industrial energy sales. Such effect must be regarded as temporary, however, and it should have little or no bearing on plans for expansion.

Impartial with Preference

"LOW COST ELECTRIC ENERGY" is made "available in an impartial manner with preference to public agencies and municipalities," according to the "Annual Report of the Secretary of the Interior, 1946."

Large cause of misunderstanding between Russia and the Western World, according to Edgar Snow in the *Saturday Evening Post* recently, is that the meanings of words are not the same on one side of the "iron curtain" as on the other. When the Russians say "democracy," "freedom," "liberty," they are not saying what we understand by those words, and vice versa.

This is not at all remarkable. How can we hope to understand the Russians when we can't understand ourselves? No doubt the man who wrote, "available in an impartial manner with preference . . ." believed he was expressing his thought clearly. But what does it mean?

WASHINGTON COMMENT

By R. N. LARKIN

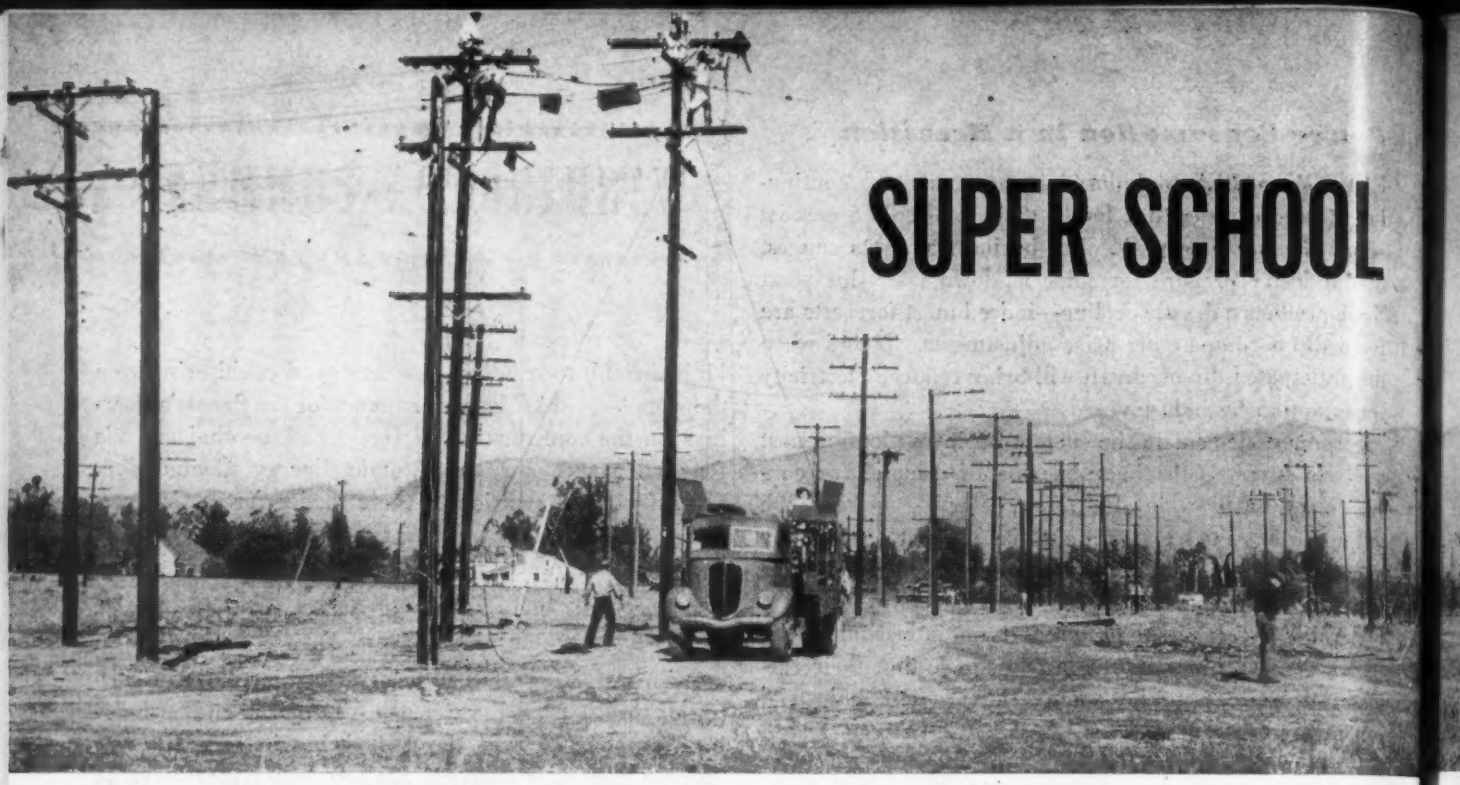
IT is difficult to conceive how any good could arise from the shambles which have been made of the Senate's hearings on the confirmation of David E. Lilienthal and his four colleagues for the Atomic Energy Commission. Still, if public revulsion to these tactics forces Congressional committees to be decent, some progress will have been made—however painfully.

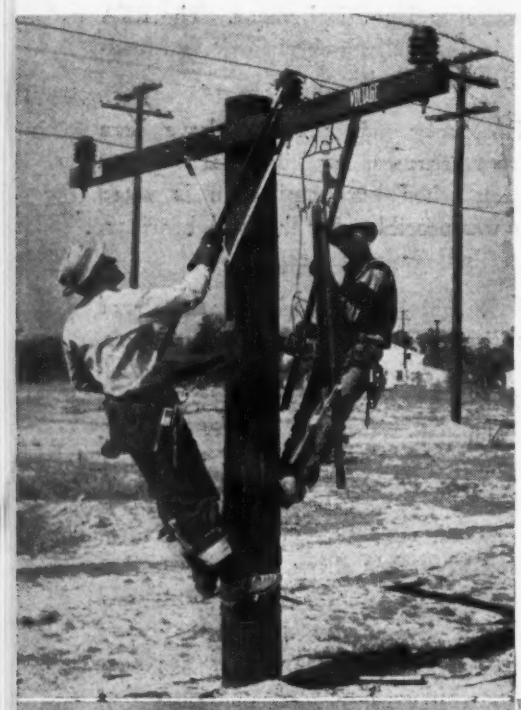
It isn't as if the AEC hearings were the first example of Congress' willingness to pillory witnesses. The Senate's investigation of the Rural Electrification Administration in 1943-44, the Senate's Patent Committee hearings of 1941-42, and the TNEC hearings of the late 'thirties and early 'forties, are too well remembered to permit the AEC hearings to stand as an isolated example of ex parte investigation and political smear. The REA investigation alone was equally nonsensical and contained fully as much witness baiting.

Actually, the REA probe may prove to have been worse than the current hearings, for Lilienthal is pretty certain of vindication when his nomination is voted upon. No such vote was possible after the REA hearings, nor was there even a final committee report.

The excesses of Sen. McKellar, unfortunately, bred corresponding absurdities by some Lilienthal supporters. According to the *New York World-Telegram* for February 18, Sens. O'Mahoney, Magnuson and Pepper charged that privately owned electric power companies were opposing Lilienthal in an attempt to establish a private ownership monopoly of atomic-electric power. Such allegations, although impersonal, are ridiculous. If these three men do not know that what they allege is an impossibility, they should study the Atomic Energy Act—and quickly. Atomic-electric power can not be a private monopoly under existing law. Today, it is a public ownership monopoly, with absolutely no guarantee that it will ever be freed for use by private power systems. Indeed, the legal possibilities that it will be available for privately owned operation are so tenuous as to be dismaying. It can only be used by private ownership under license, and the licensing authority is permissive to, not obligatory upon the Atomic Energy Commission. Standards under which such licenses might be granted are left almost completely in the hands of AEC. They will be arrived at unilaterally, and will have to be validated ultimately in the same Supreme Court which handed down the Natural Gas Pipeline and Jersey Central Power and Light decisions, the Hope Natural Gas decision, and the recent rulings on Section 11 of the Holding Company Act.

SUPER SCHOOL

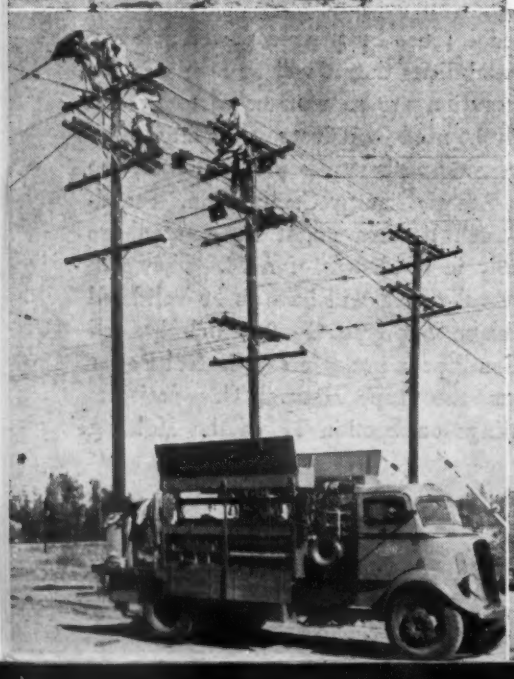


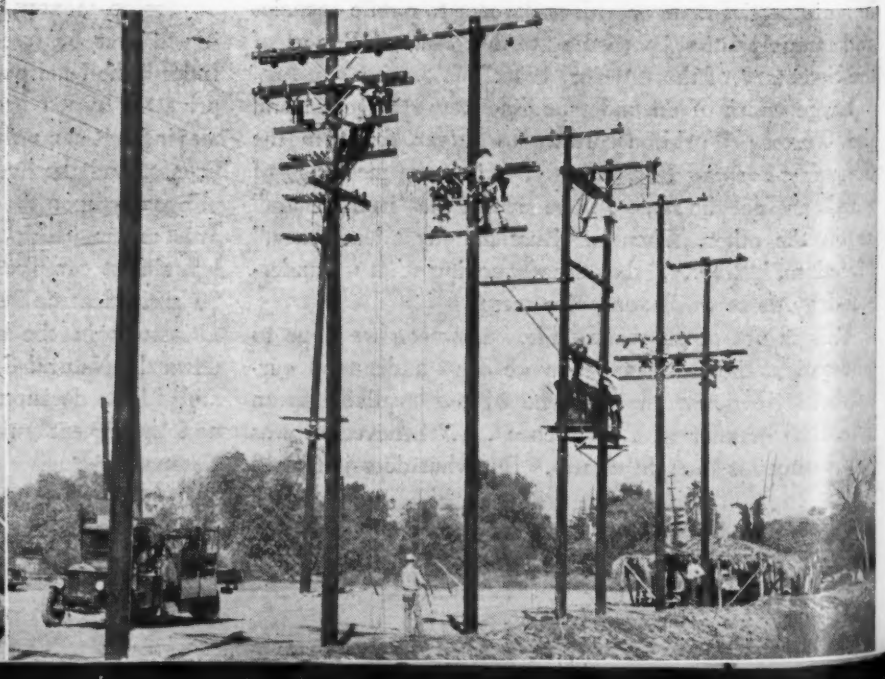


WHEN the shortage of linemen hit the Southern California Edison Co. and it became evident that it would be necessary to set up a school to train apprentices, the company did not temporize with the problem by putting up a few poles in a back lot. It went about the problem with a thoroughness and on a scale that would assure results, as evidenced by the accompanying pictorial presentation.

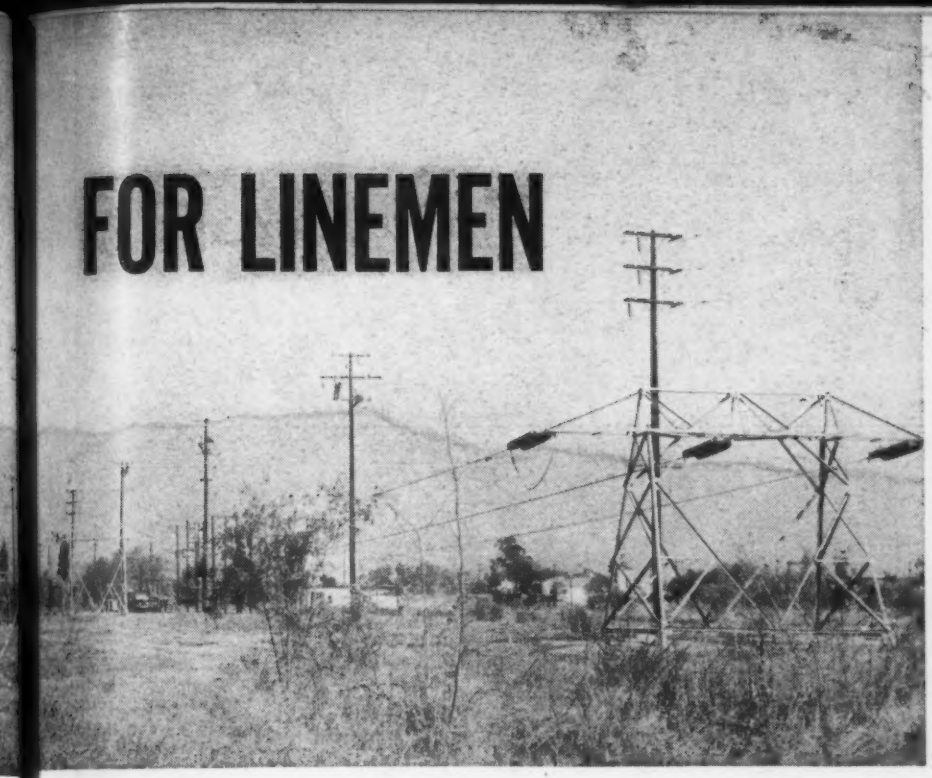
The problem was to get men and get them quickly and to train them thoroughly in every type of line work and with all types of construction and structures on the Edison system. C. T. Malloy, general superintendent of transmission, distribution and communication, turned the problem over to Roy E. McCann, administrative assistant, a man of many years' experience on the Edison system. A piece of ground containing 14 acres in the form of a plot approximately 1,000 ft. by 1,400 ft., located a few miles from its main Alhambra shops, was leased. Here were erected some 90 poles, ranging in height from 25 ft. to 70 ft., with sections of line

LIVE-LINE WORK starts at the ground, progressing in height and complexity to include circuits of all voltages up to 220 kv. and all classes of work. Learning to handle hot-line tools (left) in simple tie-wire operation. Transferring a 4-kv. corner hot (left, below), a complicated live-line job. Transformer section (below) where all types of mountings and connections are taught. Pole-mounted oil circuit breaker and capacitor installations are here also





FOR LINEMEN



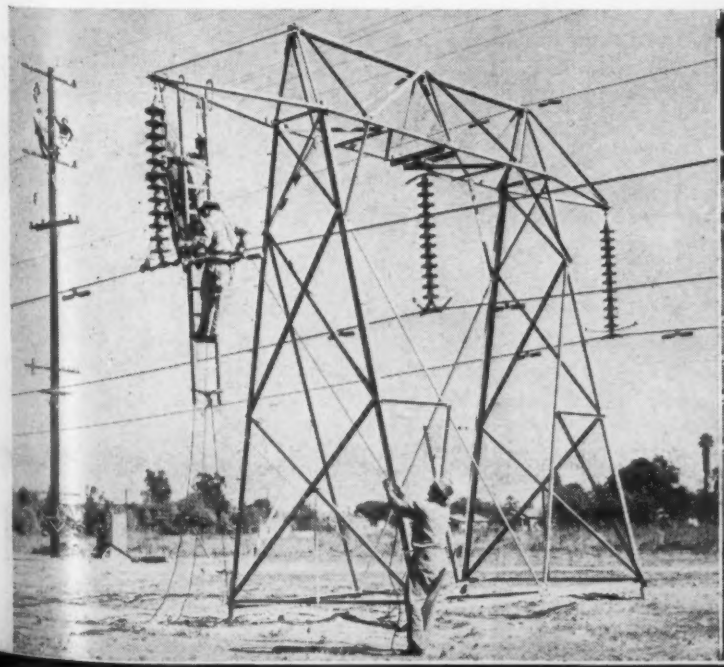
representing all voltage classes used by the company from secondaries on up to 220 kv. on short steel towers. All types of transformer mountings, from a single transformer to platform structures, were erected. Street lighting mast arms, pole-type disconnecting switches, complicated corner poles, pin-type, suspension, dead-end and post insulator construction—secondary racks, communications circuits, capacitor mounting—all are to be found. In short, it would be difficult to find a type of construction or a line problem that does not have its counterpart or cannot be duplicated at the school.

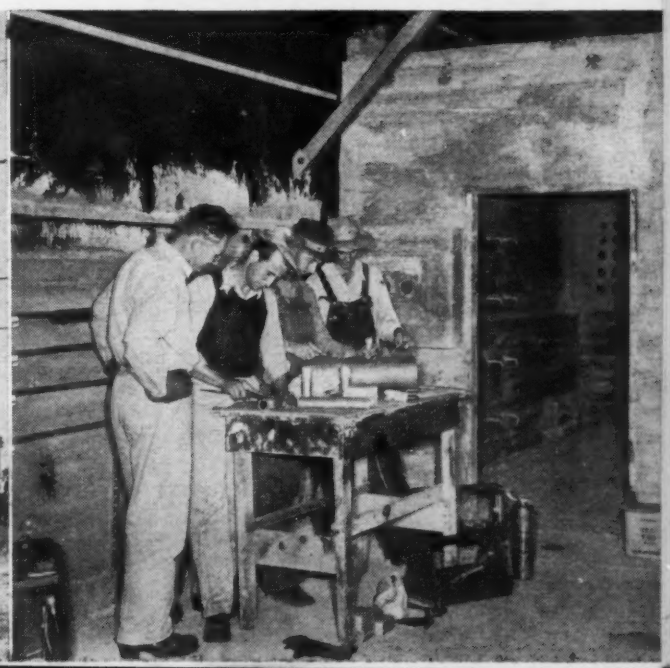
Besides the big lot which will accommodate as many as five gangs, or about 50 men, doing different work at the same time, there is a cable splicers' school with enrollment of about 18, and an inside class and demonstration room at the Alhambra yards. Theory and fundamentals needed by trainees are given in class, but emphasis is on practical work in the outside school. Roy McCann does not feel that a man needs to know anything about vectors to be a good lineman. Men taking the apprentice training are recruited mainly from GI's with some previous line experience with a utility or while in military service, and from groundmen already in the employ of the company. About 86 percent are GI's.

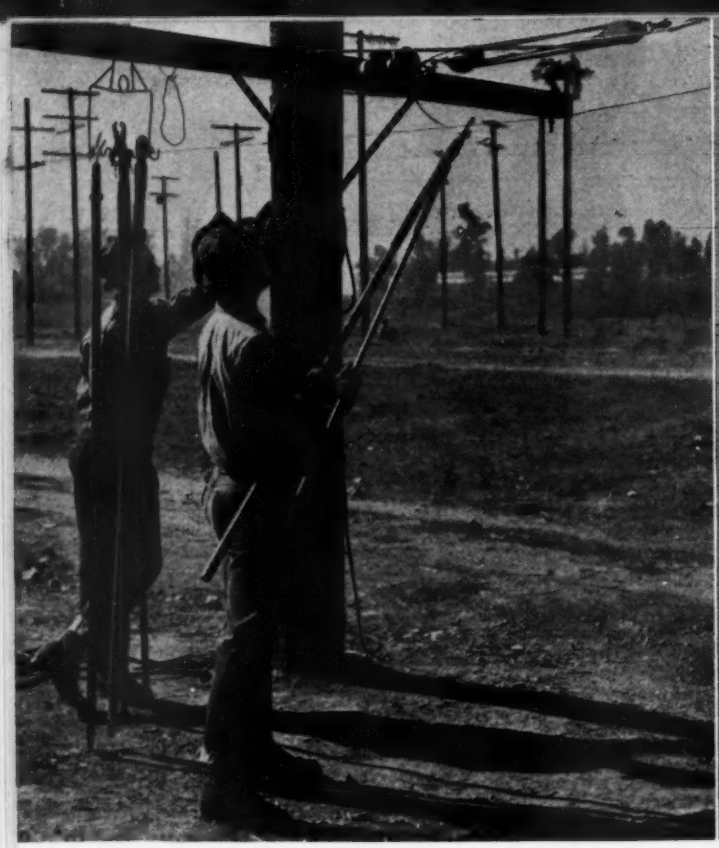
Since the course takes trainees through the fifth step of apprenticeship in four to six months' time, apprentice linemen already working for the company are also given an opportunity to attend to reduce the three years' time normally required to become a journeyman. When men leave the school they are fifth step apprentices (equivalent to 2½ years' job experience) and then after working on the job for six months, become journeymen. There are 145 years of line experience on the teaching staff. Men change from gang to gang for the various kinds of work, so that they receive training under the methods of several different foremen—a big advantage. Hot line work, because of its great importance, naturally occupies a fair proportion of trainees' time.

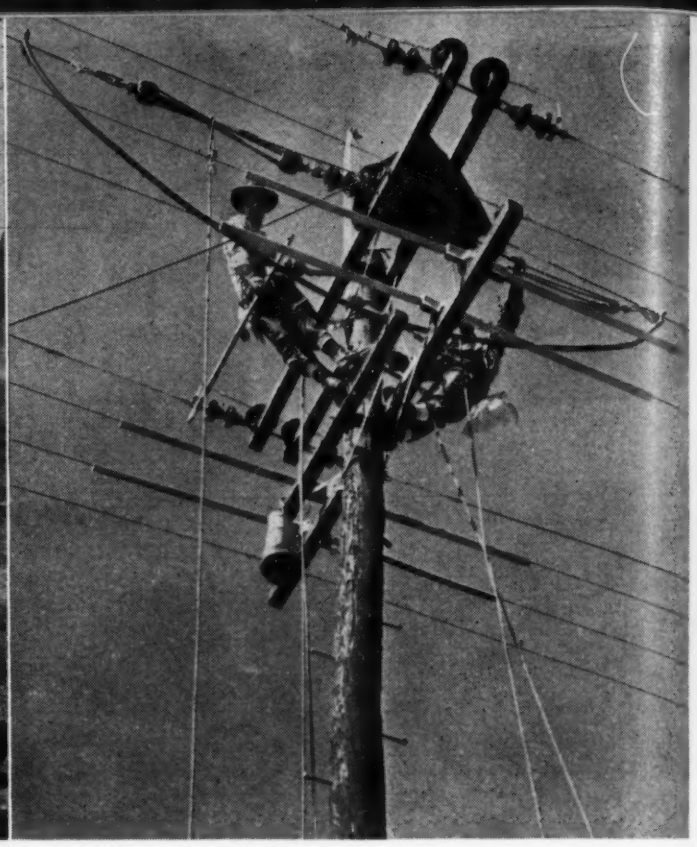
The training program is in direct charge of the operating department, with assistance by J. Long, supervisor of industrial training, and R. G. Kenyon, vice-president of industrial relations. The Southern California Edison Co. is highly pleased with its linemen's school and particularly with having laid it out on a large physical

WORKING from a ladder (left) on typical 220-kv. line. Three spans of 220-kv. line identical with much of Edison's construction, except for omission of lower section of towers, are located on training grounds. Cable splicing school—Full scale vault (right) was built where cable handling, splicing and racking as well as transformer work are taught



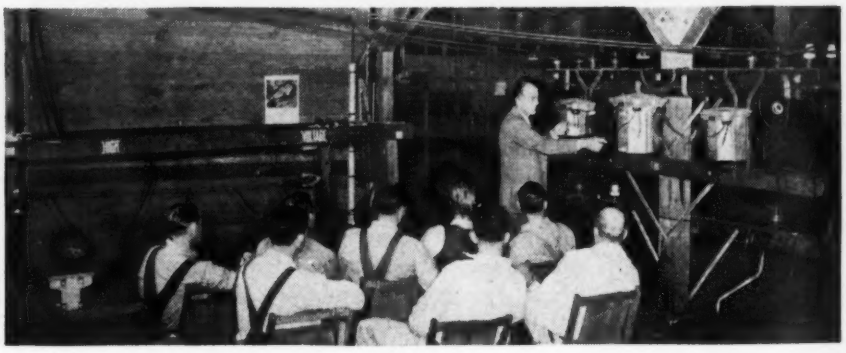






GROUND practice (left) on short poles achieves familiarity with tools and procedure. Type of line job (right) which brings in use of guards, blankets and shielded jumpers and requires advanced technique in hot-line work

scale where there is no interference between gangs, nor from the public. It is getting results at nominal cost and is producing an exceptionally well trained and efficient force. It is turning out men of estimator and line foremen calibre for the future. "In all my years of experience never have I seen such seriousness and enthusiasm—such *esprit de corps*—among men to improve their status," says H. W. Tice, Edison vice-president in charge of operation.



EXERCISES include transformer hookups tested at full line voltage

APPRENTICES learn to do a primary metering job (left) with aid of blackboard and typical installation. Installing pole-type switches (right) is another of the many and varied jobs included in Edison's apprentice linemen's school

CRANKSHAFT POSITIONING Alleviates Compressor Vibration

Electrical corrective minimizes vibration in building due to synchronous-motor-driven reciprocating compressors—Automatic selsyn control measures the angular displacement between crankshafts—Three-machine control described

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EXCESSIVE building vibrations are sometimes encountered where a number of synchronous motor-driven reciprocating compressors are located. Of particular interest are those cases where two or more compressors are operating either directly in line or side by side. When the period of vibration is of the first order, that is, in the same order as the motor speed, the disturbance might be traceable to unequal mechanical forces or insufficiently secured foundations.

Machine foundations located above the ground floor or supported on concrete piles in marshy ground are more or less free to follow any vibration forces. It is characteristic of machine foundations erected on building structures to transmit their vibrating motion directly to the building. In the case to be described here this same tendency prevailed, since both the building foundations and machine foundations were mounted on concrete piles.

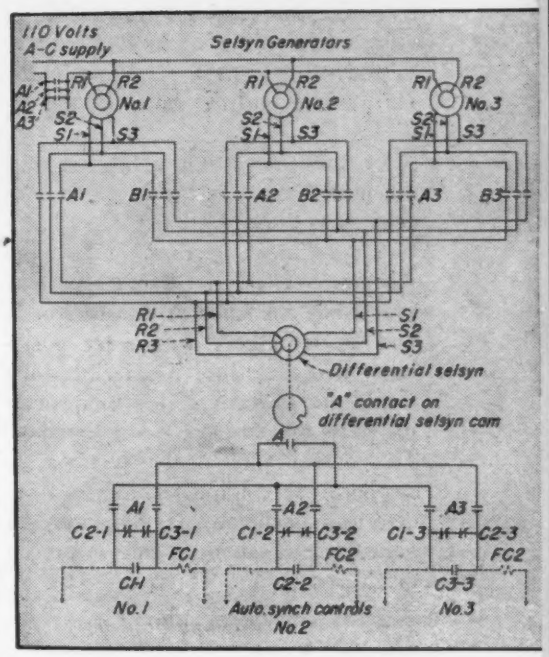
Building Vibration

Investigation indicated a definite relation between the amplitude of building vibration and the relative movements of the reciprocating parts. Maximum building vibration occurred when two or three compressors were operating with their respective reciprocating elements in phase. Conversely, the vibration of the total foundation support and the building was reduced when corresponding reciprocating parts were moving in opposite directions. In the case of two running machines, minimum vibration was recorded when their respective pistons moved 180 deg. displaced, i.e., in opposite directions. Three machines required a displacement angle of 120 deg. for minimum vibration.

Addition of flywheel counter weights or use of lightweight pistons has been quite successful in reducing foundation and building vibrations. In some cases mechanical modifications are not possible or are too costly, or else further reduction of vibration is required.

Field Application Timing

To secure an angular displacement for synchronous motor driven units, it would be necessary to control the instant of application of the field. The first requirement of the control would be to measure the angular displacement between a "running" and an "incoming" machine. The second, and this pertaining to the synchronous motors, is that the maximum speed attained by an incoming motor prior to field application, while operating as an induction motor, should be less than synchronous speed. As a final requisite, the field contactor would have to be electrically operated for quick closing. With respect to the latter feature, automatic synchronizing control is highly preferable for the time element.



SELSYN control. Normal condition; relays and apparatus deenergized

A clearer picture can probably be obtained from a general description of the details and problems worked out in a specific case. The apparatus consisted of three 2,000-hp. synchronous-motor-driven compressors, each unit rated 10,000 cfm at 110 psi. A complete unit consisted of a double duplex compressor, that is, four cylinders, with a crank angle of 90 deg. driven by an ordinary synchronous motor at a speed of 164 rpm.

Foundation Blocks

Individual foundation blocks (each 655 tons) supported on concrete piles were provided for each complete unit; each compressor unit with motor weighing 95 tons. The reinforced concrete bases, steel structure, and brick walls of the building were also supported on piles. As the building housed other electric equipment, it

was fairly large. The dimensions for this structure were approximately 60 ft. high, 160 ft. long and 75 ft. wide.

When the first machine was placed in operation, there were definite indications of horizontal vibration of the complete unit and the building. Perceptible movement of the ceiling light fixtures necessitated the taking of vibration amplitude readings. A reference column, located equidistant from the first and second machines, vibrated 16 mils near its base. Close to the ceiling most of the columns vibrated beyond the range of the indicator.

At the completion of the second machine, there was considerable concern as to the advisability of running two machines together. First, the vibration of the No. 2 machine was practically the same as that of No. 1, and second, there was every possibility that their individual vibrations would add directly if the reciprocating parts moved in phase or together. To control this phase relation, a stroboscopic method was devised for determining the angular displacement between the running and incoming machines.

Stroboscope Used

By means of a stroboscope, a fast operating electric contact on No. 1 motor shaft, and reference marks (in line with the No. 1 pole, and painted on each stator frame) an observer could determine the relative positions of the rotating parts and consequently their angular displacement. Zero displacement was indicated by the appearance of the No. 1 pole at the reference mark, 180 deg. by pole No. 23 for the 44-pole machines, and approximately poles No. 15 and No. 8 for 120 and 60 deg. respectively. As the starting equipment included automatic synchronizing panels, it was merely necessary for the observer to close a switch connected in series with the field application contactor when the No. 23 pole piece lined up with the reference mark. Application of the d.c. field immediately brought the No. 2 motor to synchronous speed and locked the field in the desired rotational position.

The reference column reading of 16 mils, for either machine, decreased to 4 mils, with both machines running 180 deg. displaced while at zero, 60, and 120 deg. 24, 22 and 16 mils were indicated. Reduced vibration was recorded when three machines were displaced 120 deg.

Three-machine Control

An automatic crankshaft positioning control designed for three-machine operation, permitted the starting of the three units in any sequence and the closing of the field contactor of the incoming motor at the selected angle. As shown on the elementary diagram, the position control apparatus consists of three selsyn generators individually geared to the three motor shafts at a ratio of 1:1 and a differential selsyn to measure the angular displacement, with a cam contact A adjustable over a range of 360 deg. A cabinet was furnished to house the necessary selecting and control relays.

For simplicity, only the essential contacts and parts are shown in the diagram. A 110-volt, a.c. supply is required to operate the selsyn equipment, while the field contactors FC1, FC2, FC3 for the three motors are operated from their individual control circuits. The selsyn equipment is energized by relay contacts A1, A2, and A3, only when required; that is when an incoming motor is to be synchronized and positioned.

The individual control (not shown in the diagram) includes automatic synchronizing and would normally complete the closing of the field contactor FC. Introduction of the selsyn positioning control, shown in solid lines, prevents the actual closing of FC until the closing of the differential selsyn control contact A, completes the FC circuit, detailed later.

First Motor Started

Normal or de-energized conditions are illustrated in the diagram. In the synchronizing of the first motor started, and where positioning is not a factor, the selsyn control does not come into play; consequently permitting the operation of the field contactor FC in the usual manner. Assume, for a specific case, the starting of machine No. 2 followed by machines No. 1 and No. 3. Any machine, of course, can be the first started and followed by the remaining two in any order. Functioning of the control is outlined.

Relays C1, C2, and C3 are associated with motors No. 1, 2, and 3, respectively, and are energized and operated after the associated motor control has completed the synchronizing operation. For simplicity the C relay coils are not shown in diagram.

Motor No. 2 has been started and synchronized in the usual manner. Relay contact C2-2 is in the closed position, while contacts C2-1 and C2-3 are open. The contact C2-2 acts as a holding circuit for field contactor FC2. while contacts C2-1 and C2-3 open and prepare the field contactor circuits FC1 and FC3 for both synchronizing and positioning.

Operating Procedure

Machine No. 1 is started and accelerated. The relays A1 and B2 are operated when the last accelerating circuit breaker closes. One A1 contact energizes the selsyn rotors, and three contacts of A1 connect the stator of No. 1 selsyn generator to the 3-phase rotor connections R1, R2, and R3 of the differential selsyn. Three contacts of relay B2 connect the stator of selsyn generator No. 2 to the differential selsyn stator terminals S1, S2, and S3. The differential selsyn then rotates at the slip speed, or the difference between the synchronous speed of selsyn generator No. 2 and the maximum accelerated speed of selsyn generator No. 1.

Since the contacts A1 in the field contactor circuits FC1 are closed and contact C2-1 is open, it is obvious that the field contactor FC1 is energized from the automatic synchronizing control circuit through the A contact of the differential selsyn. When contact A closes at the preset angle of 120 deg. for this three-machine case, the field contactor FC1 closes and is immediately sealed-in by contact C1-1. No. 1 motor is brought to synchronous speed by the closing of its field contactor and is positioned 120 deg. lagging motor No. 2. A few seconds after the operation of FC1, the contacts of relays A1 and B2 open, electrically isolating the selsyn devices. At the moment of synchronizing, the relay C1 was energized, opening its contacts C1-3 and thus preparing motor No. 3 field control for crankshaft positioning.

The sequence of control operation is the same for motor No. 3, requiring the closing of relay contacts A3 and B1. All three motors are then compelled to operate with their respective crankshafts displaced 120 deg.

High-pressure boilers converted from coal to oil. Provisions made for transferring oil from tank cars on station sidings through heaters to oil burners supplying 360,000-kw. capacity

OIL HEATERS—To facilitate atomization of oil in burners these fin-type section heaters were assembled to heat fuel oil to 200 F. From left to right are: Frank W. Schroeder, chief electrician at Fisk; the author; Howard Wiedow, boiler room watch engineer

Boiler Conversion Eases Fuel Crisis

PAUL B. JUHNKE
Formerly Chief Operating Engineer
Commonwealth Edison Co., Chicago, Ill.

EMERGENCY CONVERSION of seven high-pressure boilers from pulverized coal to oil fuel, at Fisk and Northwest stations of The Commonwealth Edison Co., Chicago, during the height of the first 1946 soft coal strike, freed 360,000 kw. of the system's 2,303,000 kw. of generating capacity from reliance on coal.

Only high-pressure boilers were converted at both stations. Other boilers were chain-grate units and could not be converted short of major alterations. Conversion at both plants was similar. It involved heating the Bunker C fuel oil to about 105 deg. F. in railway tank cars so that it would flow or could be pumped to transfer tanks.

Fisk Conversion

At Fisk station four boilers were converted. Two of these, rated 375,000 lb. per hr. each, supply steam at 1,200 psi., 900 deg. to a topping turbine which, with its low-pressure turbo-generators, has a capacity of 85,000 kw. The second pair of boilers supplies steam at 1,250 psi., 925 deg. to a 147,000-kw. condensing unit. These boilers are rated 750,000 lb. per hr. each.

Bunker C fuel oil was brought into spur tracks adjacent to the Fisk boiler room, twelve tank cars at a time. But since at moderate temperatures fuel oil is too viscous to flow or be pumped readily, it had to be heated to about 105 F. before removal from the cars. Railroad tank cars are normally provided with coils for heating the oil with low-pressure steam. Piping for this heating steam had to be provided at the sidings together with piping to connect the cars with the two 5,000-gal. steel transfer tanks used at Fisk.

Three motor-driven centrifugal pumps (two 250 gpm. and one 750 gpm.) drew oil from the transfer tanks and pumped it through an oil heater within the plant that raised the oil temperature to about 200 F. for ready atomization in the burners. This heater was made by connecting 30 fin-type heater sections in parallel. In effect the resulting heater consists of a nest of concentric pipes 660 ft. long. The outside pipes, which are 4 in. in diameter, carry fuel oil under pressure. The 2-in. inner pipes carry the heating steam. At Fisk the heater will handle 480 gpm. of oil, raising its temperature from 100 F. to about 200 F.

Leaving this heater, oil passes through a header system to 80 steam-atomizing burners of 6-gpm. capacity in the four boilers. These burners were inserted through openings in the existing burner casings at appropriate points. It was not necessary to change the coal burners to do this.

Changes at Northwest

All three converted boilers at Northwest supply steam to the same topping unit at 1,250 psi., 925 deg. and are rated 425,000 lb. per hr. Rating of the topping unit, including its low-pressure turbo-generators, is 135,000 kw. Total station capacity is 215,000 kw.

Conversion details differed from those at Fisk in that oil from the tank cars passes to two 150-gpm. gear pumps that discharged into a single 3,000-gal tank. From the tank it is picked up by another set of three 125-gpm. gear pumps and passed under 350 psi. to a fin-type section heater similar to those at Fisk. At Northwest as at Fisk, oil burners were inserted in the existing coal burners without making any major changes. At both stations oil flow was usually controlled.

Effective Standardization

HERVEY A. BROWN
The Cleveland Heater Co.
Cleveland, Ohio

IF A MORE progressive and specific standardization of the electric water heater is achieved, as regards both product and service, the result would be a pronounced stimulus for a much greater public acceptance of the appliance. Utilities would benefit in revenue because the addition of each heater improves the questionable profits from the range alone. It would lead to increased sales for the manufacturer, distributor and dealer together with a more competitive and acceptable service for many users.

A recent market survey* shows, of those who intend to buy gas ranges, 70 percent intend to buy gas water heaters. In this same area, of those who intend to buy electric ranges only 5 percent intend to purchase an electric heater. In the well developed agricultural section, partially served by gas, the ratio is even more disparate. Only 1 percent will purchase the electric heater out of 33,912 electric range prospects.

Basic Questions

Why is the electric water heater not keeping pace with the range when the two are complementary in load building and service? Why is it lagging so far behind other major household appliances? Is it because it lacks the standardization of other appliances, as to both the product and the service? Is it because the time-switch-controlled, extremely low-recovery heater does not adequately meet increased hot water requirements, especially automatic home laundry machines? Is the large capacity tank objectionable or is initial cost retarding acceptance? Can it be rate structures are not attractive nor uniform? Is mass production possible when manufacturers must produce several hundred styles and models, including tank sizes, combinations of elements, thermostats and other accessories? Is it possible to develop electric heating extensively when specialty selling is necessary on account of numerous specifications and restrictions?

For a beginning towards real acceptance of the electric water heater the utilities, not 70 percent but 99 percent, must lean over just a little in the interest of standardization. They must balance the manufacturers' problem of standardization and the customers' acceptance of the service against demands, load factor, diversity, minimum wattages, time switch control, charging hours and special rates. Responsibility for standardization must be directed to them because the manufacturer, distributor, dealer and customer have no choice other than to produce, stock, sell and accept some particular heater that has approval of each of 300 utilities. With 30 percent of utilities not endorsing NEMA-E.E.I. element standards and as many more accepting them only with reservations, it is obvious where responsibility for the present situation lies.

Standardization and economical production can be accomplished overnight provided specifications would permit fewer tank sizes, elements, and especially combinations of elements and thermostats. No manufacturer can go into continuous production when he must await receipt of numerous specifications which can make combinations running into thousands. Under NEMA-E.E.I. standards, seven different elements are required to assemble the popular 30-, 40- and 52-gal. single and twin heaters. When wattage ratings are based on 20, 30 and 50 watts per gallon no two elements of the same wattage can be used in either the lower or upper positions. Certainly this is not even an approach to standardization. The desirability of increasing the watts per gallon is now under serious consideration by water heating committees. We have been trying to sell marginal hot water service, governed too strictly by load characteristics, that presents a problem each time a few extra gallons are used. Not only should the lower element wattage be increased but balanced with the upper element for standardization and better service.

Range Business Marginal

Summarizing the statements of many utility officials and cost experts, the large majority opinion is that the range business alone is either unprofitable or marginal. The consensus is, any profit from the residential range is more certain or is improved after a heater has been added. There is a wide disagreement as to whether controlled or uncontrolled service is necessary for satisfactory returns. Some utility men insist controlled practice is necessary indefinitely. A number think it is now desirable and can be dropped later, while others have already abandoned the idea. One-third of utilities permit uncontrolled service. The time of day the heater is allowed to operate varies widely as does also the duration of operation. No one intends to question the decision of a utility in adopting controlled or uncontrolled service because of economics. The point here is that so many different operating practices do not offer encouragement for standardization of the product or service.

Too many heater studies seem to be adverse, in their effort to justify elements of extremely low wattage, large tanks, and controlled service, rather than seeking the possibilities of using average tanks, moderate wattages, rendering a flexible service, accomplishing standardization and reducing

* Pacific Gas & Electric Co. Survey reported in *Electrical Merchandising*, December, 1945.

# of Water Heaters Is Needed

prices. Quite a few studies do not seem equitable in analyzing the merits of controlled versus uncontrolled practices, also of different wattages. For instance, one report includes only fourteen 1,500-watt heaters. Such units will not show their maximum diversity in groups of less than 25 to 30. Interruption by time control adversely affects the demand and load factor of 1,500-watt heaters far more than of 600-watt heaters. Therefore a complete examination not only requires a sufficient number of units under survey but records should be taken for both continuous as well as controlled operation. And also the cost of larger tanks and the value of good hot water service should be placed on the scales.

Another report relates the advantages of control in a study of only twelve heaters on wash day. Can controlled service be justified for many normal days when ¼ cent for each kw.-hr. sold or $7.50 a year per heater is required to pay for time switch control? A utility first recommended the 30-gal. twin heater, then later the 40-gal. Today they approve the 52-gal., yet maintain low wattages. While tank sizes become inflationary we still cling to 20 watts per gallon for the lower elements.

For 80 Percent of Users

The 30-, 40- and 52-gal. capacity tanks can serve 80 percent of users. It is advisable to keep one small and one large heater in the line, the 10-gal. for 8 percent of prospects and the 66-gal. for 5 percent. A 30-gal. table top should be included and the 10-, 30- and 40-gal. sizes be available in both square and round models. These few sizes and models will supply 95 percent of the trade and this is the first step towards standardization.

It will not add much to a manufacturers' inventory to stock 30-gal. tanks for both single and twin units. For better standardization all 40-, 52- and 66-gal. heaters should require two elements. Accordingly such element arrangement would be the second step towards standardization.

The third and most important step is to standardize on two wattages, 1,500 and 2,000, almost exclusively. There is little hope for standardization as long as specifications require numerous wattages and combinations. The 600-, 750-, 1,000- and 1,250-watt elements should be eliminated. On a 20-watt-per-gallon basis they would be a complete failure without large storage tanks and upper emergency elements of almost twice the size. Elements of 1,250 watts and less do not recover the average hourly use of 5 to 6 gal. during the morning and early afternoon. When disconnected

NEMA Water Heater Standards

Editor's Note—For the convenience of readers who may wish to refer to them, here are the NEMA standards for electric water heaters as regards tank sizes and wattage ratings, quoted from NEMA Publication No. 45-104, May, 1945.

"WH4-20 Wattage Rating of Elements for Electric Water Heaters

"The standard wattage ratings of 230-volt elements for use in electric water heaters shall be as follows: 600, 750, 1000, 1250, 1500, 2000, 2500, 3000, 4000, 5000.

"WH4-25 Standard Wattages for Single-Element Heaters

"The standard wattage of single-element heaters shall be in accordance with the following table:

Tank Size in Gallons		Wattage Rating	
Approx. Range	Nominal	50 Series	20 Series
Over 30 to 35	30	1,500	....
Over 35 to 45	40	2,000	....
Over 45 to 55	52	2,500	1,000
Over 55 to 70	66	3,000	1,250
Over 70 to 90	80—90	3,000	1,500

"WH4-30 Standard Wattages for Twin-Unit Heaters

"The standard wattages for upper and lower elements for twin-unit domestic heaters of 30-gal. capacity and larger shall be as given in the following table:

Tank Size in Gallons		Wattage Rating of	Wattage Rating of
Approx. Range	Nominal	Upper Unit	Lower Unit
Over 30 to 35	30	1,000	600
Over 35 to 45	40	1,250	750
Over 45 to 55	52	1,500	1,000
Over 55 to 70	66	2,000	1,250
Over 70 to 90	80—90	2,500	1,500
Over 90 to 115	110	3,000	2,000
Over 115 to 135	120	4,000	2,500
Over 135 to 175	140	4,000	3,000

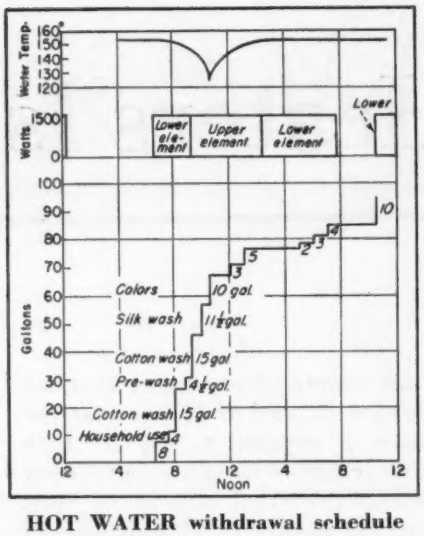
"The above wattage ratings are based on the application of 30 watts per gallon of tank capacity in the upper unit and 20 watts per gallon of tank capacity in the bottom unit with the wattages rounded off to the nearest standard element wattage rating.

by time switches they can hardly recover minimum day use. The tank gradually becomes depleted, throwing far more work on the high wattage upper element than we are inclined to admit and thus forcing the use of large and more costly tanks. The 1,500-watt element in the lower position is the minimum wattage that will recover average hourly use and retard depletion of hot water. This is very important on wash days when the washing cycle can be started with a full tank of hot water. Under heavy draws, a minimum of 1,500 watts is necessary to pre-heat water in the lower part of the tank sufficiently to assist the upper element for faster recuperation.

The definite value of higher wattage in the lower position of twin heaters is illustrated by the accompanying chart which shows the delivery performance of a 40-gal. heater with 1,500-watt elements in both positions and with interlocking thermostat to limit demand to 1,500. Severe withdrawals were made on a schedule in accordance with the expected maximum requirements for automatic home laundry equipment together with household use. Under the same schedule a 40-gal. heater with NEMA-E.E.I. wattage non-interlocking thermostats failed with the 41st gallon. the capacity of the tank, even though the total wattage in operation was 2,000 against 1,500 for the first heater. A 52-gal. heater with NEMA-E.E.I. wattages gave little better service than the first heater even though the total wattage in use was 2,500. These tests show how it is possible to use smaller tanks or improve the service by increasing the wattage of the lower element and balancing it with the upper element. The demand is less with interlocking thermostats, thus the load-factor is higher. And such arrangement permits standardization.

Heater Demand

What are the load characteristics to be expected from 1,500-1,500-watt interlocking heaters? Actual results show that when 1,200 30-gal. heaters, 1,000-1,000 watts with interlocking thermostats, were disconnected at intervals with carrier control the load at the substation dropped 560 kw. Therefore the diversified demand for each heater was 466 watts. Tests



HOT WATER withdrawal schedule for household use and for four complete washes with automatic home laundry machine. Tank, 40 gal.; upper and lower elements, each 1,500 watts; interlocking thermostat; cold water temperature, 65 deg. F.; maximum demand, 1.5 kw.; energy consumption, 20 kw.-hr.; load factor, 55 percent

show heater demands are about 50 percent higher in winter than summer. So to compare these records taken in June with data accumulated in winter at another location, we are increasing the demand in ratio to 700 watts per heater. Another very comprehensive study charts the demand for a 30-gal. single 1,500-watt heater to be just a little higher than 700 watts in a group of 170. Since no records can be taken under identical conditions we realize some variables are involved; nevertheless they indicate there is little or no difference between the daily average maximum diversified demand of 1,000- and 1,500-watt heaters. If this is true, then why not substitute a 1,500-watt element in the lower position of 52-gal. heaters for the 1,000-watt NEMA-E.E.I. standard? With interlocking control the demand would be 1,000 watts less, load characteristics just as favorable to the utility, service materially improved and standardization would be possible with both elements of the same wattage.

Another dependable study concludes there is not much difference in the daily average maximum diversified demand of 30-gal. heaters with 1,000-600-watt elements and the single 1,500-watt. If we accept this analysis then we can add a 1,500-watt upper element to the lower 1,500-watt with interlocking thermostats without increasing demand and the load characteristics would remain about the same as the 1,000-600-watt heater.

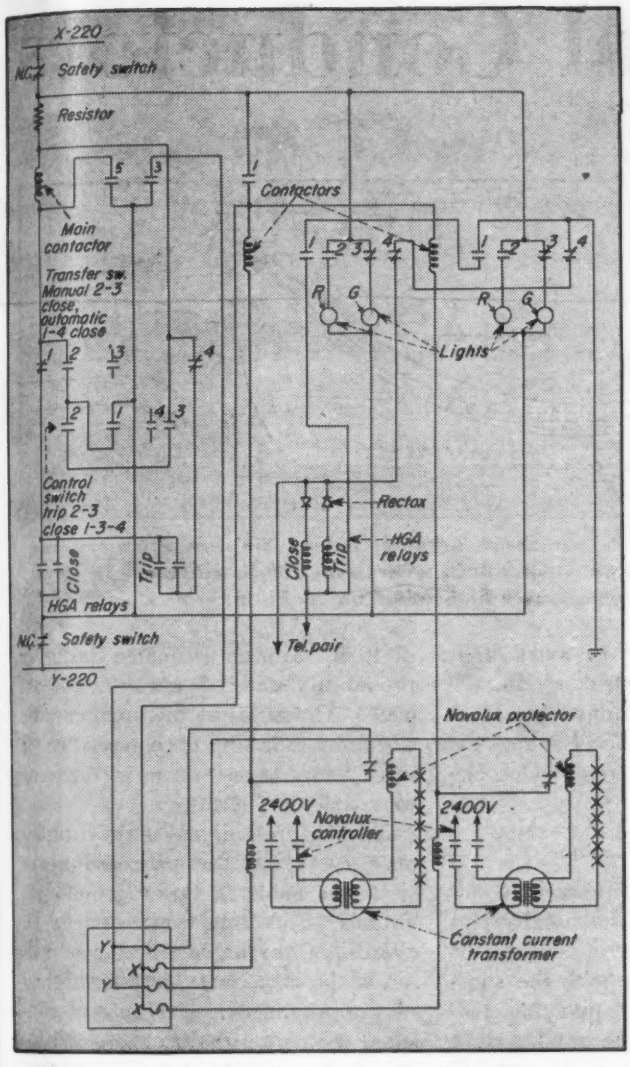
From these studies we learn there is little difference in load characteristics of 30-gal. heaters with 1,000-600-watt elements, 1,000-1,000 watt interlocking and 1,500-1,500 interlocking. Plotting the individual demands against the diversified demand we get almost a straight line. However, as the wattage is gradually increased we have reason to believe the demand will increase and this curve will turn upward. If this curve did not turn decidedly upward at 2,000-watt individual heater demand we would have a very valuable answer to the most important heater problem. We could use 2,000-watt elements in both positions of 30- and 40-gal. heaters with interlocking thermostats. Hot water service would approach perfection. Load characteristics would be just about as favorable to the utility as lower wattages and combinations now specified. Standardization of both product and service could be quickly accomplished for nationwide application. Such a procedure would result in a short line of standardized water heaters.

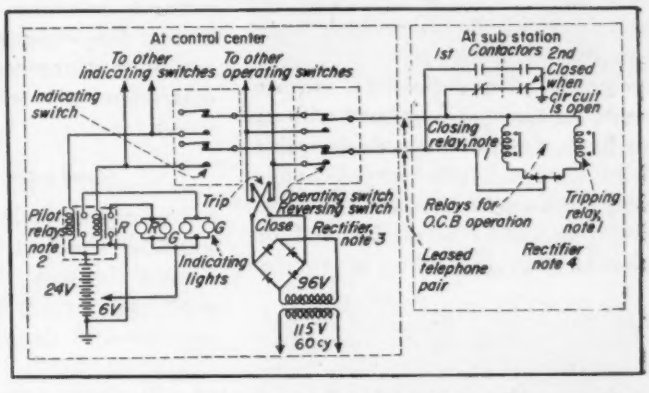
Conclusion

In conclusion: The history of nearly every industry shows that lower prices and greatly increased usage have followed closely on the heels of standardization. The matter of a few watts per gallon or a few hundred watts for the lower element stands between standardization, greater revenue, volume sales, improved service and better prices. Those who are concerned with the sale of electric water heaters, with the development of water heater load, must consider the advantage to be obtained by popularizing a single design for national distribution—like the 30-gal. gas water heater, the 7-cu. ft. refrigerator, the 9-lb. washer, the four-burner range with 16-in. oven. We suggest the 40-gal electric water heater with interlocked 1,500-watt elements in bottom and top positions. The American housewife demanded faster electric cookery and then faster electric freezing. She is now demanding faster electric water heating with average size tanks.

REMOTE CONTROL of STREET LIGHTING

F. R. MILLER
Supervisor of Substation Operation
The United Illuminating Co.
New Haven, Conn.





GENERAL SCHEME of remote control (right) by rectified current from load dispatcher's office. In general, relay and switch contacts operate only momentarily . . . [*Note 1. Relays are G.E. Co. type HGA-15T with coil having 15,000 turns and resistance approximately 1,900 ohms . . . Note 2. Relays are Western Electric Co. type U-160 . . . Note 3. Two G.E. Co. model 6RC-3B-14OY rectifiers for full wave, deenergized when not in use . . . Note 4. One G.E. Co. model 6RC-3B-32 V. rectifier.*] **Arrangement of circuits, contactors, relays and series lamps (left) at substations equipped for remote control of highway lighting**

STREET LIGHTING in the New Haven area is furnished through groups of four to seven constant-current transformers installed at various substations. There are also two sections in this area served by individual "RO" transformers cascaded from other series circuits. Each circuit is controlled by a "Novalux" oil switch mounted at the c.c. transformer. This switch is operated from the dispatcher's office over a leased telephone pair running to the substation. All circuits have protectors in the load side which will deenergize the primary of the c.c. transformer in the event of an open circuit due to line failure. The relays and power sources required are shown.

To close the light circuits the reversing switch is put in the "closed" position and the operating key depressed. Rectified current for polarizing is sent over the telephone pair to the closing relay which energizes the main contactor. The main contactor seals itself in and energizes closing coils on the oil switches.

To trip the circuits the reversing switch is put in the "trip" position and the operating key depressed. The tripping relay is energized and its contacts short-circuit the main contactor coil, which drops out, opening the circuit to the closing coil on the "Novalux" oil switches.

Supervisory control for breaker position includes an indicating switch at the control center and an auxiliary relay operated by the main contactor at the receiving end. The indicating switch connects a 24-volt battery consisting of twelve dry cells to the line.

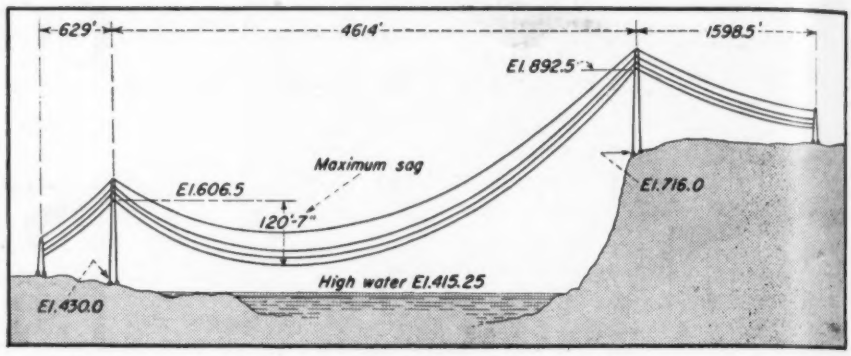
It is planned to install a monitor system to indicate switch outages, high oil temperatures in transformers and fire alarm. This will be done over the same pair of telephone wires.

All control switches and indicating lamps are mounted in a compact box on the dispatcher's desk. The box also contains the relays and battery. A master switch has been provided for the a.c. control so it will be impossible for accidental contact with the control circuits to cause the street lighting circuits to trip.

Conventional Conductors

F. P. KASPAR

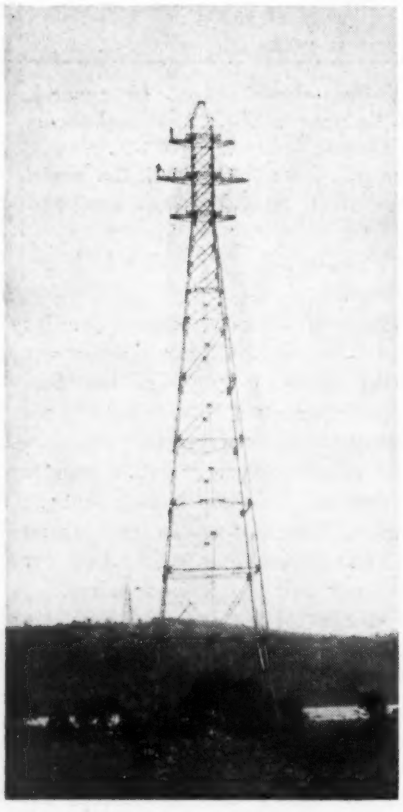
Chief Design Engineer
Oklahoma Gas & Electric Co.
Oklahoma City, Okla.



PROFILE of 4,614-ft. span across Arkansas River. Six conductors and one ground wire are supported on 230-ft. towers with 286-ft. difference in elevation. Minimum clearance over high water 55 ft. 11 in.

CONVENTIONAL high-strength conductors supported on moderately high towers are used in the 4,614-ft. Arkansas River crossing span constructed to clear all footings from soil erosion danger. Devastating flood waters had cut a 1,400-ft. wide channel and later destroyed a tower of the crossing, which has been replaced. A rock bluff 300 ft. high supports one of the new towers and an inland site 15 ft. above high water supports the other.

Mechanical and electrical requirements for the span were met with extra high strength copperweld cable, $\frac{9}{16}$ in. (19-No. 9), 30 percent conductivity. Six conductors are used, one circuit operating at 66 kv. and the other at 36 kv. Shielding is provided by one ground wire of extra high strength galvanized steel, $\frac{9}{16}$ in., 19 strand. Sag computations were for a minimum clearance of 55 ft. above the maximum recorded flood water elevation.



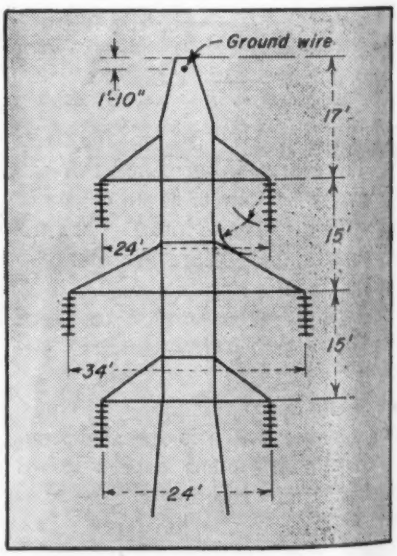
MAIN SPAN tower ready for insulators and conductor stringing

Conductor Spacings

Iced conductor loading and unloading studies indicated that inadvertent contact between the conductors is practically impossible with the spacing shown in the accompanying configuration sketch. The total weight of a conductor with $\frac{1}{4}$-in. ice is 4,400 lb. and the bare conductor 3,200 lb. Normally, a conductor does not shed all the ice instantly; therefore it was concluded that the rebound magnitude of a heavily weighted bottom conductor, while shedding ice in 200 to 300-lb. pieces, could not be sufficient to touch the nearest loaded upper conductor.

The crossing is equipped with one ground wire to shield the line conductors, within a 30-deg. protective angle, from direct lightning strokes. Evidence on long span river crossing flashover trouble indicates that mid-span flashover is the principal cause. By employing a 50-ft. clearance between the ground wire and the phase conductors for the long span, it was estimated that mid-span flashovers could be reduced to about 3 percent. Clearances above 50 ft. increase the susceptibility of the phase conductors to "side flash." After all the factors affected by this clearance were investigated, a compromise clearance of 40 ft., with an estimated flashover probability under 5 percent, was selected. Crossings of this type may be struck by lightning once every two or three years to as much as three or four times a year.

After a preliminary test-rod resistance survey at the proposed tower sites was made, a tower ground resistance of 50 ohms was assumed. To coordinate the impulse flashover values at the protection level established by the ground wire clearance at mid-span, it was decided to use eight 10-in. insulator units per string in suspension and at the deadends. Recent



CONFIGURATION for suspension crossing tower. Two 8-unit, 10-in. insulator strings are used in suspension, with three strings at dead ends

Used On 4,614-Ft. Span

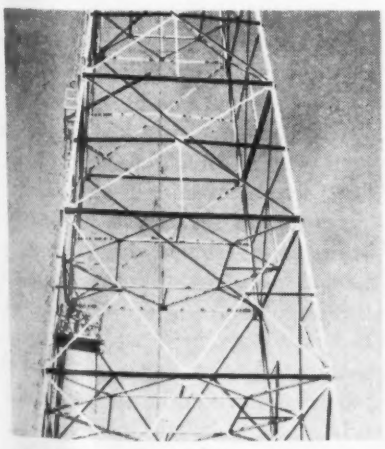
Double circuit shielded with one ground wire—Mechanical requirements include ice loading—Short wave radio aids wire stringing—Sag checked by dynamometer and transit

ground resistance tests, conducted near the end of a dry season, disclosed readings well below 50 ohms except at the suspension tower on the bluff. An attempt will be made to reduce the 60-ohm resistance at this tower, by extending the radial counter-poises and driving more ground rods.

Tower Construction

The 230-ft. suspension towers are constructed from structural steel shapes, galvanized after fabrication, and all connections are bolted, with locknuts at all bolts. Each tower required 110,400 lb. of steel. The deadend towers are 72 ft. and used 33,000 lb. of steel.

Vertical caged ladders, with landings at two intermediate elevation levels, were attached to each suspension tower. To facilitate stringing of conductors and future maintenance of insulators and conductor fittings, walkway gratings, with 42-in. high railings, were installed on the crossarms. The tower on the bluff is equipped with marker lights at the intermediate points and blinker lights at the top, to meet the Civil Aeronautics Authority specifications. The lights are controlled automatically by a light sensitive relay.



SCAFFOLD is erected on tower leg to mount transit for final check on conductor sagging of main span across river

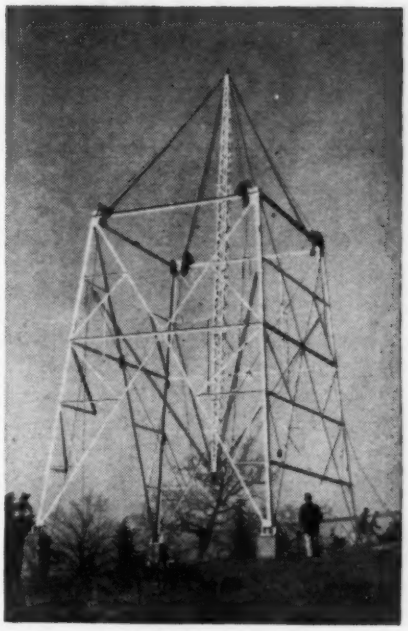
Conductor Stringing

Short wave radio stations were used to facilitate the stringing and sagging operations.

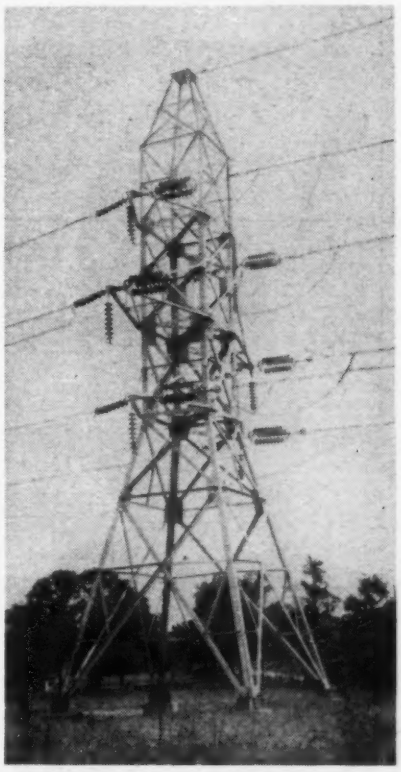
For the conductor stringing, a stranded steel tow line was threaded through a single sheave block at the top of the highest support tower, thence carried across the river by boat and raised to conductor position on the second tower. From the second tower the tow line was carried through a sheave block secured near the base of the anchor tower, and finally attached to a winch line. The tail end of the tow line was spliced to the conductor in the payout reel with wire rope clips. A hand-actuated, rope-snubbed drum secured to the payout reel maintained sufficient tension on the conductor to keep it clear of the water and intervening obstructions. This procedure was repeated for each conductor. Two workmen guided the tow line-to-conductor splice through the sheave block.

Sag Checked

For one week, the conductors remained suspended on the towers at 4,000-lb. tension. Thereafter, each of the conductors was prestretched to 10,000 lb. for one hour. Following this operation, the conductors were placed at the final sag position. A transit, placed at previously computed locations on the lower level suspension tower, was used for the final sagging operation in the main span. The sag was also checked with a tension dynamometer. Deflections of deadend towers, observed during the stringing and sagging operations, were accounted for in the final clipping operation.



BASE PLATES are supported at top of grout line level on four short ¾-in. leveling screws, grouted in as part of tower footing after completion. Basket gin is being elevated



DEAD END anchor tower completed except anti-climbing guard. Tower is 72 ft. high, weighs 16 tons

ANALYZER CHARTS PERFORMANCE OF HYDRAULIC GOVERNORS

B. F. GOSTIN • Supervisor of Load Control and Telemeter Maintenance, Tennessee Valley Authority, Chattanooga, Tenn.

AN ANALYZER, primarily designed to assist in making the proper compensation settings on governors which were being placed in service for the first time, was found to serve admirably as a test unit on older governors when routine inspections and adjustments were made. When used in conjunction with a high speed frequency recorder or a recording wattmeter, a complete analysis of the performance of the governor is obtained directly on the recorder strip chart.

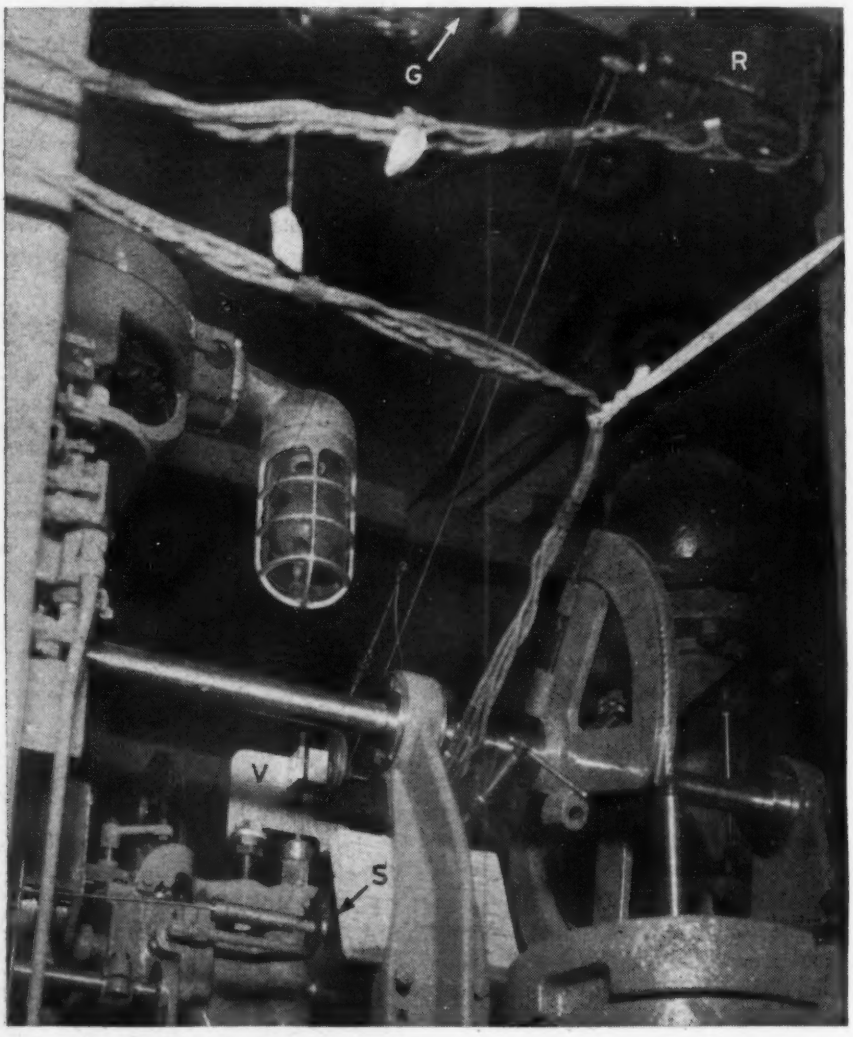


FIG. 1—Typical test set-up on a Woodward governor. "G" is a selsyn generator coupled to show gate motion. "R" is a selsyn generator coupled to show relay valve motion. "S" is a selsyn generator coupled to show speed adjustment motion. "V" is an attachment used in recording relay valve motion

Component Parts

The analyzer (Fig. 2) consists essentially of three selsyn motors geared to pen-driving mechanisms and a variable speed chart-drive mechanism. The selsyn motors are provided with reversing switches so that they will always read "up-scale" for either direction of motion of the selsyn generator. The pen-drive gear ratio is adjustable from 4:1 to 1:4.

The chart, chart-drive roll, and take-up roll are from a Bristol strip-chart recorder. The chart-drive clock is from an Esterline-Angus recorder and affords all chart speeds from $\frac{1}{4}$ in. per hr. to 12 in. per min. Pens are L. & N. long barrel and are driven by flexible radio-dial cables, while on the right end a solenoid-operated index pen runs on the chart margin and is used to apply synchronizing marks on the chart.

Supplementary Parts

An attachment "V" (Fig. 1) used in recording relay valve motion consists of a rack and pinion driving a 4-in. pulley. A cup fastened to the bottom of the rack slips over the relay valve stem and is clamped to it by means of set screws.

In a subsequent improvement a special cable connects the selsyn generators to the recorder. It is a 12-lead, radio-analyzer type and is provided with a 12-point Jones plug on the recorder end. On the opposite end are spliced three lengths of 5-lead cable terminating in 5-point plugs. A 5-point jack is mounted on each selsyn generator. This cable saves an appreciable amount of time in making the

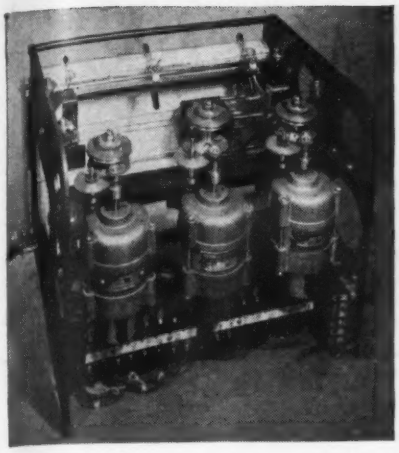


FIG. 2—Analyzer for hydraulic governor performance has selsyn motors to operate pens

set-up and insures correct polarity on each selsyn.

A companion frequency recorder is provided with an index pen which is usually operated in parallel with the analyzer index pen; it has two ranges, 55-65 and 60-100 cycles.

Typical Procedure

Fig. 1 shows a typical test set-up on a Woodward governor. This test set-up is used to obtain the governor characteristics when the machine is used for load regulation.

When an initial "load rejection" test is made, the selsyn "S" is coupled to show blade angle position on units which employ a Kaplan mechanism. Best chart speeds are 6 in. per min. for load regulation performance analysis and 12 in. per min. for load rejection tests.

Driving cords between the selsyn generators and the governor mechanism are kept under tension by means of coil springs.

Most selsyn systems have an inherent dead band around their balance point; however, this may be minimized by operating the selsyns at 10 percent to 15 percent overvoltage during the short time required for a test.

After the equipment has been set up on the governor, the governor should be manually operated through the range expected so that the pen position, drive ratio, etc., can be adjusted to the desired position on the chart. At the same time a calibration of the pen position vs. governor motion is made for future analysis of the record.

Composite instrument comprising three recording pens operated by individual selsyn motors indicates gate motion, relay valve motion and speed adjustment motion

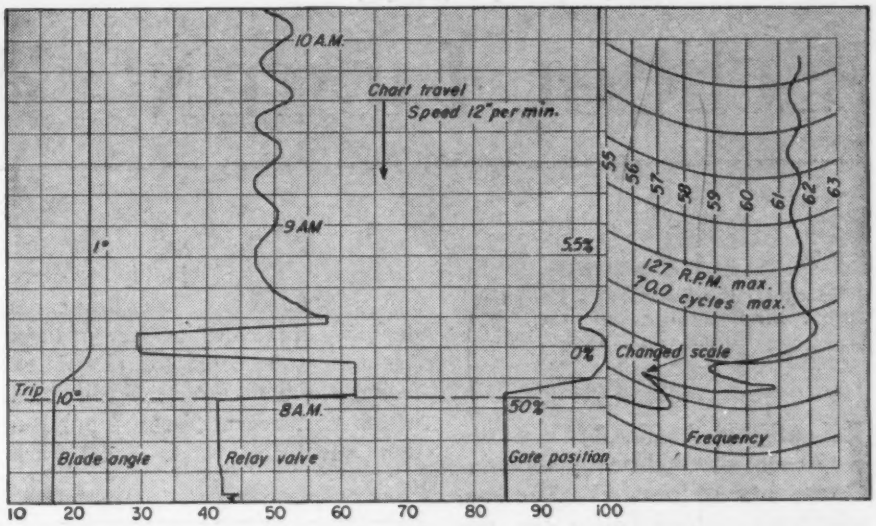


FIG. 3—Load rejection test made on a 32-mw. generator at 75 percent load. At instant of trip, relay valve opened full and frequency started to rise. Initial gate motion lagged by 0.3 sec., while initial blade motion lagged by 1.0 sec. Peak frequency recorded was 70 cycles; following this, frequency recorder was switched over to low scale to get more accurate reading of floating-over frequency. 2.8 sec. were required to close gate from 50 percent open position, while machine stability was obtained in 10 sec.

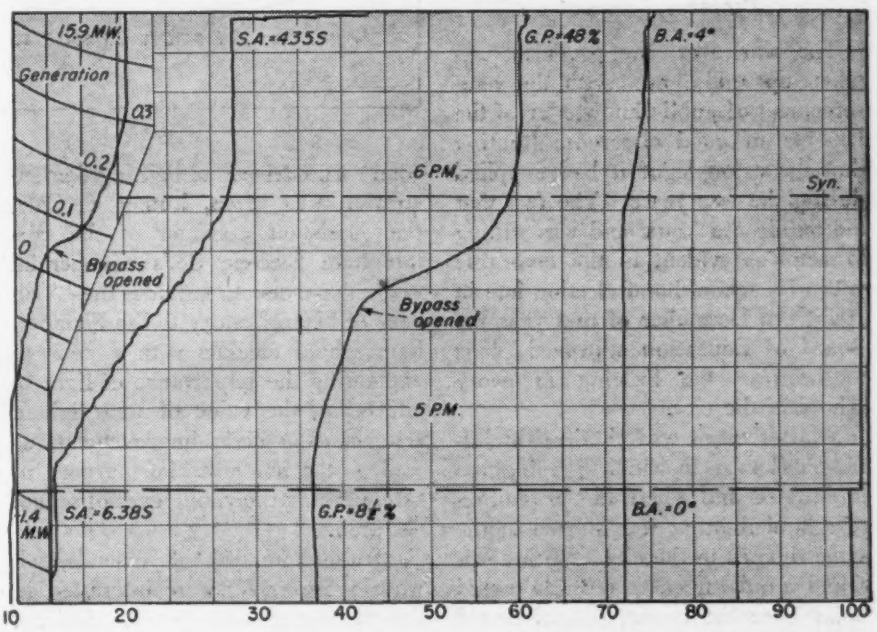


FIG. 4—Performance test showing response to a 15-mw. change at 2 percent speed drop. Head 59 ft. Chart speed 6 in. per min. Indicates the point at which the automatic by-pass valve on the dashpot opens. Machine operated by automatic load control equipment, and control impulses were transmitted to the speed adjusting motor for 18 sec. While gate motion stopped about 2.5 sec. after impulse cut-off, blade angle continued to change for about 7.0 sec.; and therefore the generation did not cease changing until about 8.0 sec. following impulse cut-off. This condition would be detrimental to tie line load control and therefore must be eliminated by proper adjustment of the Kaplan mechanism and interrupter time in the impulse circuit

City-Wide
SCHOOL LIGHTING PROMOTION

ROY H. KNOX
Manager, Advertising, Sales Promotion
Birmingham Electric Co.,
Birmingham, Ala.

Lack of funds prevents improvement in lighting of schools, but electric company gets a number of classrooms properly illuminated and awakens public to the need — As soon as war is over, bond issues are voted

IN ABOUT A QUARTER of the 70 schools of Birmingham, Ala., one or more classrooms had been adequately lighted before the war called a halt on the program of improvement. This result had been accomplished through the efforts of the Birmingham Electric Co. in bringing home to school authorities and to citizens a realization of the values of modern school lighting.

Program Resumed

The war over, the program was taken up again, now with the reinforcement of public knowledge of the benefits of good classroom lighting that the example of it had supplied during the war years. The fact that the public did know and was willing to act was evident in the favorable vote of a school bond election late in 1945. In December of that year the Board of Education approved plans to improve the lighting in every school in the city.

Similar result was obtained in Jefferson County in which Birmingham is situated and where the promotion of school lighting was started at the same time as in the city. With additional funds from a recently voted bond issue the county school board has made plans for modern relighting of the schools that come under its jurisdiction.

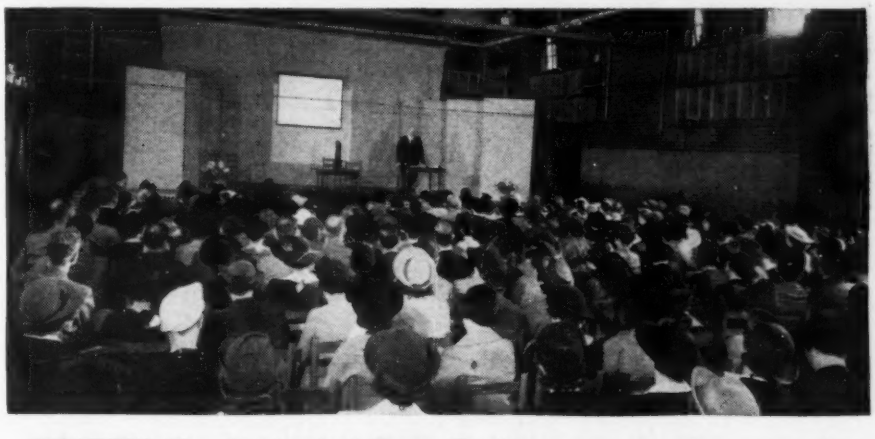
Back in 1935, when national surveys and discoveries in the relationship of light and vision suddenly awakened electric utility people to the deplorable lighting conditions existing in schools, many of Birmingham's 70 school buildings were equipped with one or two drop cords in the classrooms while a few of them were not even wired for electricity. Spurred by the information contained in the "Science of Seeing" publications and by a visit to NELA Park where a model school lighting demonstration was given, Luther T. Cale, then assistant manager of the Birmingham Electric Co.'s commercial sales department, carried the "Science of Seeing" story to the Birmingham school officials with a view to explaining the importance of light to education, the value of well lighted schools as a civic improvement, as well as the humanitarian purpose of safeguarding the young eyes of school children.

Birmingham school officials, always progressive, were interested in the modern educational facility. However, like many other improvements which they desired for their schools, modern classroom lighting was a dream to be realized in the distant future, because the school system suffered from the age-old plague of inadequate funds.

Realizing that the school board was helpless to secure funds for school lighting, no matter how imperative it might be to the welfare of the student, in the early part of 1937 Mr. Cale approached the Birmingham School Masters' Club, an organization whose membership is composed of principals of the city and county schools and members of the city and county boards of education. Club president C. J. Going aided in plans for a complimentary luncheon by the electric company and invitations went out to all city and county school principals, superintendents, and school board members. The attendance at the luncheon was highly gratifying and the enthusiastic acceptance of an address by J. M. Ketch from Nela Park was more than satisfactory. At this luncheon, a display of student lamps made by Birmingham high school students under the direction of the manual training supervisor, Vernon J. Douglass, from blueprints furnished by the Birmingham Electric Co., gave emphasis to good lighting for studying. Raymond J. Hurlburt, principal of the Hemphill grade school, declared himself an immediate prospect for a sight-saving classroom installation. It was in his school that the first model lighting

Gets Results

OUTSTANDING as an example of complete lighting with the latest fluorescent equipment and of adequate protection by germicidal lamps, is the Shades-Cahaba school in Jefferson County, Ala. This is one of the classrooms



MEETINGS like this inspired Parent-Teacher groups to raise money for demonstration installations of modern lighting in classrooms

installation was made, serving as the objective for other schools in the city.

Important outgrowths of the School Masters' meeting became visible within a few months. School principals interested Parent-Teacher groups in obtaining better lighting for classrooms. They promoted "Light" as the topic for project teaching among members of their faculties. An educational program embracing all parties interested in school lighting, students, teachers, parents, principals, and school authorities, was organized and set in motion.

Parent-Teacher Participation

Parent-Teacher Associations, with the help of the electric company, held luncheons in their own schools and used the proceeds to apply toward properly lighting one classroom at a time.

Lighting recommendations developed were transformed into blueprints by the electric company and furnished to the schools free of charge. Inspection tours of Parent-Teacher groups from one school to another to view properly installed classroom lighting were sponsored. National lighting experts were brought into Birmingham to lecture before school groups and their lectures were of course mentioned in local newspapers. Through guidance by the company, schools were advised as to the purchase of proper paint and lighting fixtures, thereby permitting Parent-Teacher groups to realize their objective quickly.

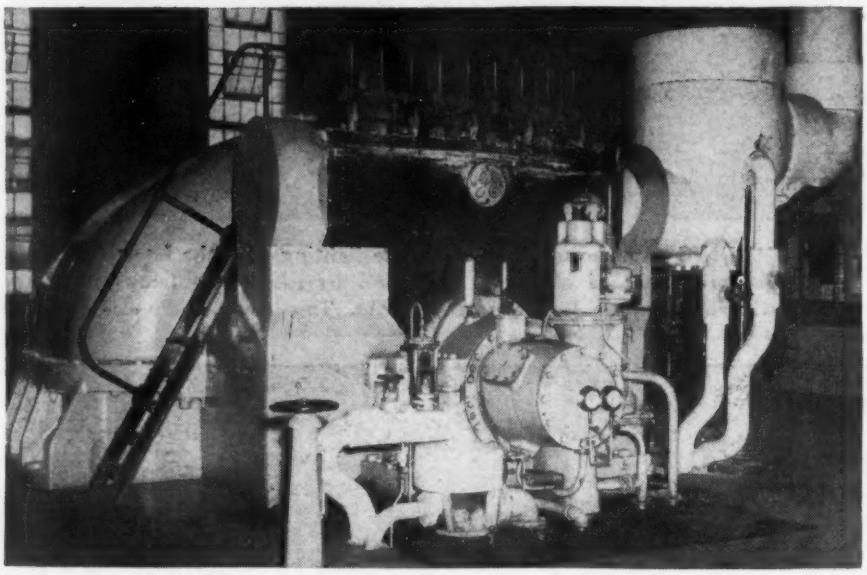
Many voluntary testimonial letters, as well as requested testimonials, from students, teachers, and parents followed practically every new lighting installation. Testimonial letters, pictures of good installations, blueprints and explanations were made into sales presentations and used by members of the commercial sales department in their school activities. The department carried on an intensive lighting training program for its own personnel, using the G.E.-La Salle Lighting Training Course as a basis of training. Each salesman became expert in recommending the proper lighting for each classroom according to the activity performed there, and after measuring the classroom he was furnished a blueprint, made by the company's illuminating engineer, which he there presented in turn to the school authorities free of charge.

No official survey has been made in the Birmingham schools which have light-conditioned classrooms, but letters from principals and teachers declare that pupils have shown improvement in grades, nervous tension is lessened, and the classroom presents a cheerful atmosphere conducive to greater scholastic effort. Under the leadership of progressive school officials, civic organizations, interested parents and teachers, good lighting is now recognized as a factor in school construction equal in importance to proper ventilation and heating. The president of the city Board of Education declared at a recent board meeting that regardless of obstacles, Birmingham children must have the protection of good light in the schools. And, as recited in the opening paragraphs of this story, they are going to have that protection.

HOW

DESIGN • CONSTRUCT • OPERATE • MAINTAIN

Mineral Wool Applied to Turbine Steam Chest



STEAM CHEST insulated with 3 in. of mineral wool cement

Two 30,000-KW. main generators with tandem connected auxiliary generators of 1,500 kw. each for station use are installed at the Sayreville, N. J., plant of the Jersey Central Power & Light Co. The turbines operate at 450 psi., 700 deg. F. and the steam-chests (see illustration) are conventionally steel-lagged outside, and further to eliminate heat loss, insulated inside with 3 in. of mineral wool cement. The rear water-wall of one boiler is now being used as a test installation of mineral wool insulation consisting of a 3-in. mineral wool blanket with ½ in. of mineral wool cement over it. In general, mineral wool is preferred because of its "knit" fibrous structure in addition to its very low "k" factor.

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An ELECTRICAL WORLD *Comparison of Practice . . .*

Manning and Functioning of the Trouble Department

TROUBLE SHOOTING can be the most exciting part of distribution operation, but most of the time it involves nothing more difficult than going into a customer's cellar to replace a blown fuse. During a few storms each year there may be wires to untangle from tree limbs. In other shifts there may not be a single fuse call. There may be dull moments but few men can equal the trouble-shooter for variety of tasks and conditions in the course of a year.

A survey of practices in 20 companies shows that almost without exception men are selected for transfer to trouble work after experience in construction or maintenance crews. Practices differ on the division of work, with eleven companies having some men assigned for service fuses and secondary work only. In two of these cases, primary work is dispatched to a small construction or maintenance crew, while in the others there are primary or power troublemen classifications. In nine companies, the troublemen do both secondary and primary work.

Practices of 20 Companies On Customer's Inside Service Trouble

16 Respond to all calls without question.
4 Attempt to minimize house fuse service by questioning at time of call.

15 Replace fuses but make no further check if fuses hold.
5 Check for cause of fuse-blowing.
3 Also make minor repairs or bring appliance in for repair.

5 Make no charge for service call or fuses.
9 Charge for fuses used.
8 Charge for service call.

In all except the two companies dispatching primary work to other crews, the trouble linemen are equipped with enough tools to cut lines in the clear and some can make minor repairs up to 4 kv. The same men also operate single blade disconnects and pole top switches. Although a separate group of men handle street light repairs, troublemen in ten companies are prepared to replace street lamps and globes and to patrol circuits.

Eight of the companies have radio service for dispatching trouble calls

and all of the others indicated they are planning to install equipment as soon as it is available. All except five companies have troublemen on some intermediate work, minor maintenance, checking transformers, etc., at times while waiting for emergency calls. Where radio is not used, the men call their dispatcher at intervals unless they can be reached promptly by telephone.

Meter Changes

Four companies assign troublemen to meter changes, while two of this group also make minor appliance repairs on the customer's premises, or check carefully and bring the appliance in for repair if necessary. Only a few companies reverse the procedure and have meter or appliance repairmen to replace house fuses.

In four companies trouble is handled by a separate department and in the others it is a section of the distribution department. In no case is the trouble work a part of a meter or service department, except that the calls from customers may be received by a central service desk and passed on to the trouble dispatcher.

Customer Service Varies

All companies attempt to restore service as promptly as possible when the trouble is on their own lines or equipment. There is considerable variation, however, in policy for trouble on the customer's wiring and appliances, as shown in the accompanying tabulation.

Service Charges

Twelve companies make no charge for the service of replacing house fuses but seven of this group do charge for the fuses used. Eight companies charge the customer for the trip or service and two charge also for the fuses used. Charges are: one at 25 cents (plus cost of fuses), two at 50 cents, three at 75 cents (one plus fuses), and two at rate of $1.00 for trip.

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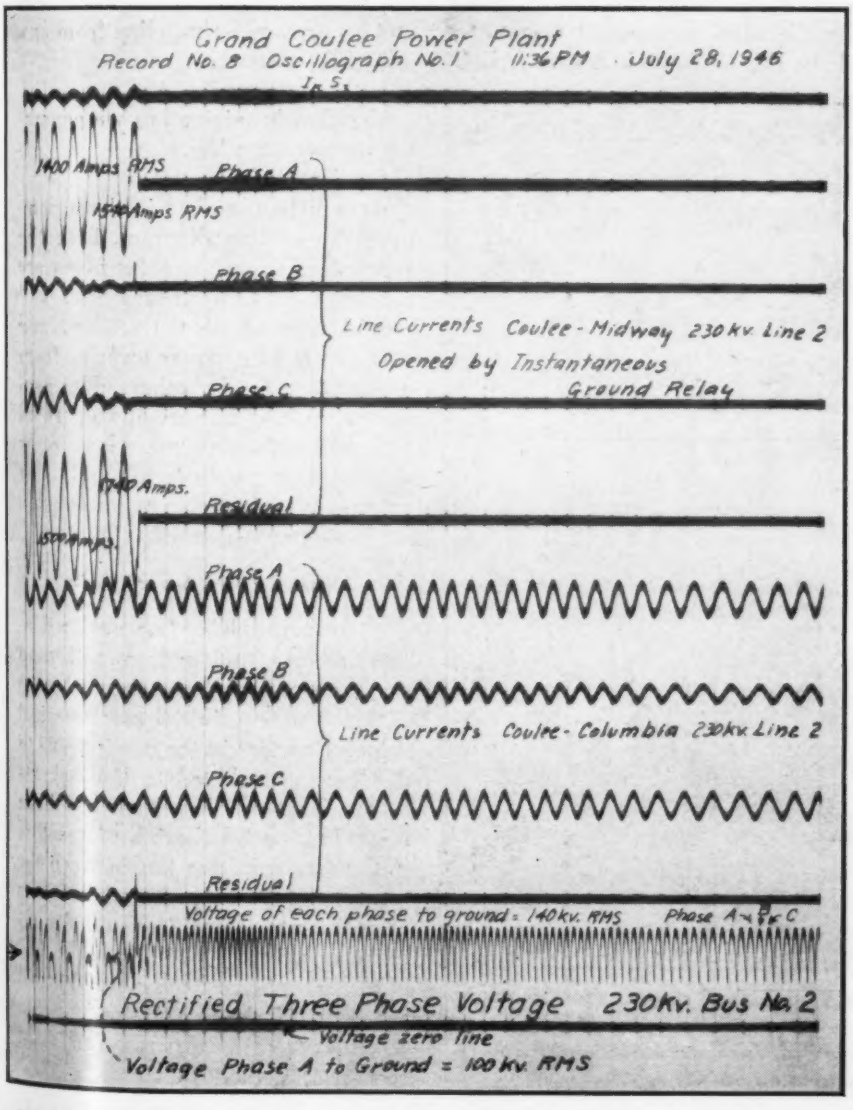
Single-Element of Oscillograph Records Three Line Voltages

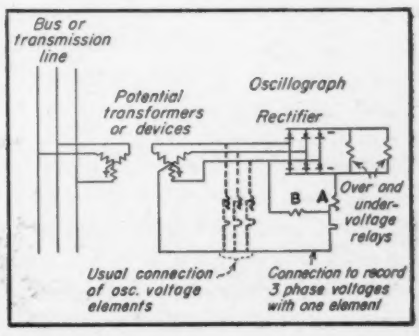
FERBER R. SCHLEIF, Engineer, USBR, Coulee Dam, Wash.


Grand Coulee Power Plant
Record No. 8 Oscillograph No. 1 11:36 PM July 28, 1946
1400 Amps RMS
Phase A
1540 Amps RMS
Phase B
Line Currents Coulee - Midway 230 Kv. Line 2
Opened by Instantaneous Ground Relay
Phase C
1400 Amps.
Residual
1540 Amps.
Phase A
Phase B
Line Currents Coulee - Columbia 230 Kv. Line 2
Phase C
Residual
Voltage of each phase to ground = 140 kv. RMS Phase A, B & C
Rectified Three Phase Voltage 230 Kv. Bus No. 2
Voltage zero line
Voltage Phase A to Ground = 100 Kv. RMS

OSCILLOGRAM showing deflection (left) for each of the phase voltages in succession, made possible by connection "A" shown in the accompanying wiring diagram

IN USING automatic oscillographs, information is nearly always desired on many more quantities than there are individual elements available. The scheme shown in the accompanying diagram has been found quite useful in obtaining all of the desired information on the three-line, phase-to-ground voltages with one element, without sacrificing clarity.

The scheme consists of a simple electrical connection as shown at "A" without the use of additional equip-



SIMPLE connection at "A" (above) permits recording three line voltages with one oscillograph element. Resistor at "B" is for unbalancing the voltage trace for identification if desired

ment. The oscillograph element with its series resistor for voltage recording is connected between the neutral or ground point of the three-phase voltage it is desired to record, and one of the output terminals of the rectifier which operates the undervoltage and overvoltage starting relays, as shown. In this way the three-phase full-wave rectifier also supplies a half-wave rectified voltage to the oscillograph element. This causes the oscillograph element to deflect for each of the phase voltages in succession as illustrated in the reproduced oscillogram.

The peak deflections are spaced at 120 electrical degrees, or three peaks per cycle, making the individual phase voltages readily distinguishable. Under balanced conditions the trace returns to one-half its maximum deflection between peaks and, where no zero liner is available, this can be used as a calibration reference. The particular phase voltages may be readily identified by lining up any phase current peak with its corresponding phase voltage peak at power factors anywhere near normal.

Unbalancing the Trace

The single trace for recording the three phase voltages may be slightly unbalanced, if desired, so that phase "A" peak voltage, for example, is slightly higher than the peaks of phases "B" and "C." This is useful where the most information can be obtained by recording line residual currents, rather than phase currents. The bus voltage trace with one phase identified will indicate the phases involved in any fault. Unbalancing the voltage trace for identification may be accomplished by connecting a resistor from the lead of the phase voltage it is desired to identify directly to the oscillograph element, shunting the rectifier and calibrating resistor, as shown at "B" in the diagram. The value of this resistor "B" should be about 20 times the value of the calibrating resistor "A."

• • •

Flexible Bus and Switching Layout in Plant Extension

IN BUILDING the third section of Venice No. 2 power station, the Union Electric Power Co., St. Louis, Mo., established a scheme of electrical connections which insures maximum reliability of supply to outgoing feeder groups.

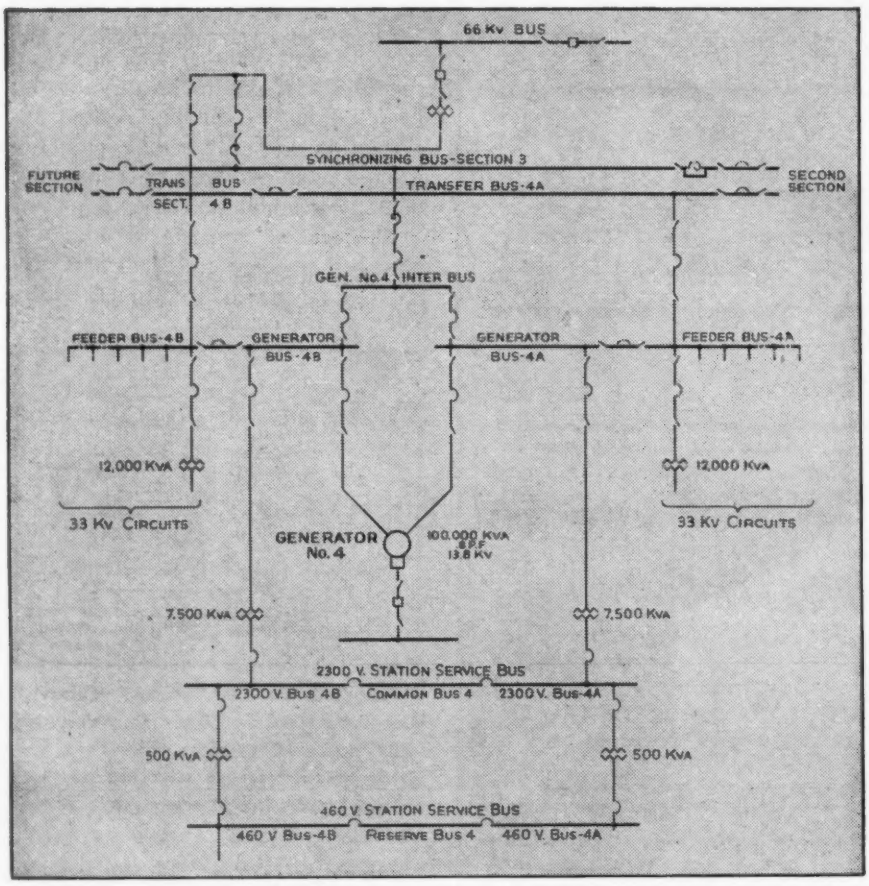
When reviewing this design before the Electrical Equipment Committee of the Edison Electric Institute, C. C. Dodge of the Stone & Webster Engineering Corp., engineers on this project, pointed out that each feeder circuit group may be supplied from any one of three sources:

(a) Generator No. 4.

(b) Synchronizing bus via generator intermediate bus.

(c) Transfer bus.

As will be observed in the accompanying one-line diagram, both the synchronizing and transfer buses are connected through to the first and second sections of the station, and may be used for power transfer from one section to the other. The synchronizing bus is normally operated with all breakers closed, whereas the transfer bus is intended only for emergency operation or for equalizing load between units.



ONE-LINE DIAGRAM of third section of Venice No. 2 station, showing triple supply facilities to feeder groups through use of generator, transfer and synchronizing buses, with tie-ins to older section of plant and provision for future expansion and continued flexibility of operation

Stresses from Short Circuits

The synchronizing bus and its connections are designed to withstand stresses resulting from short circuits of 190,000-amp. initial asymmetrical value. Reactors in the connections to this bus are selected to limit shorts to a safe value. Provision has been made for the installation of reactors in the synchronizing bus between the second and third sections when future extensions to generating capacity require this.

In a later issue a short account will be given of the design for utilizing metal-clad switchgear in this third section of Venice No. 2.

what's new in GE street lighting

Sodium lamp life EXTENDED 33%

NOW it is more economical than ever before to use distinctive, modern sodium lighting! Thanks to a new cathode developed by General Electric, you can now count on sodium lamps for an *extra* 1000 hours of service.

Yes, the life rating of General Electric sodium lamps has been extended from 3000 to 4000 hours—*at no extra cost to you.* Your replacement costs are less. Service calls are fewer—and farther apart. In tunnels, where operation is continuous, the new lamp is rated at 8000 hours.

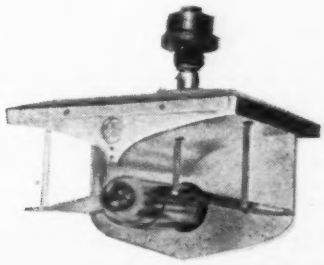
The ideal safety lighting for danger spots

With the *extra economy* of General Electric's new sodium lamps, you have more reason than ever to take advantage of the *extra safety* of this modern type of lighting. Type M-2 sodium luminaires are highly efficient distributors of penetrating, caution-colored, easy-on-the-eyes light. They relieve the blinding effect of bright oncoming headlights, and outline pedestrians and traffic conditions long distances ahead. In many cities sodium lighting has markedly reduced accident rates—at intersections, in tunnels, over bridges and along busy highways.

Easy to install

Modern, attractive General Electric luminaires can be mounted according to any conventional arrangements used for standard incandescent luminaires. Circuit wiring can be overhead or underground. Lamps operate on any conventional series or multiple circuit.

A.F. Dickerson, manager of the General Electric Lighting Division, Schenectady, N. Y., examines the new cathode.



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Graphical Determination of For Transformers

J. E. GAHAGAN, Ansco Division of General Aniline & Film Corp.,

GRAPH SIMPLIFIES the determination of the heating attainment factor of the top oil of a distribution transformer when the transformer is installed in a naturally ventilated vault enclosure for which the thermal characteristics are known. The heating attainment factor in this instance is the ratio of the top oil temperature rise over the outdoor 24-hr. average ambient air temperature during a specific time interval to the ultimate top oil temperature rise above the same reference for a particular load condition.

Use is made of the heating attainment factor in calculating permissible transformer loadings based on thermal considerations when the transformer is subjected to cyclic loading, or in determining transformer operating temperature for a particular load cycle.

Inclusion of the vault heating constant (K′) in the equation is an approximation but calculation procedure is simplified without appreciable error. Magnitude of the error in calculated top oil temperatures has been found generally not to exceed about 5 deg. C. on closely controlled tests for load cycles having peak values as high as 150 percent of transformer nameplate rating. The error is proportionately less for lower peak load values. Since the many factors influencing the ultimate answer are not usually known with sufficient accuracy to permit a precise calculation, the above approximation is justified.

The vault heating constant (K′) is a measure of the heat dissipating ability of the vault enclosure and is usually obtained from tests. The constant is a function of several items such as vault volume, ventilating area and arrangement, earth temperature, outdoor ambient air temperature, exposure to sun, transformer location in the vault, transformer losses, etc. It may be defined as the effective ambient air temperature rise within the vault enclosure above the average 24-hr. outdoor ambient air temperature per kilowatt of loss to be dissipated from the vault.

The effective ambient temperature within the vault is difficult to measure and is more generally obtained by subtracting the known top oil temperature rise over its surrounding air, at the test load under consideration, from the observed top oil temperature. The temperature, thus obtained, minus the average outdoor ambient temperature gives the effective vault air temperature rise. For example: Outdoor 24-hr. average

The graph provides a solution for the equation

$A = 1 - E^{-t/t'}$

where:

A = attainment factor
E = Naperian logarithm base
t = time in hours
t' = thermal time constant in hours
t' = SH
S = thermal storage factor in kilowatt-hours per degree Centigrade

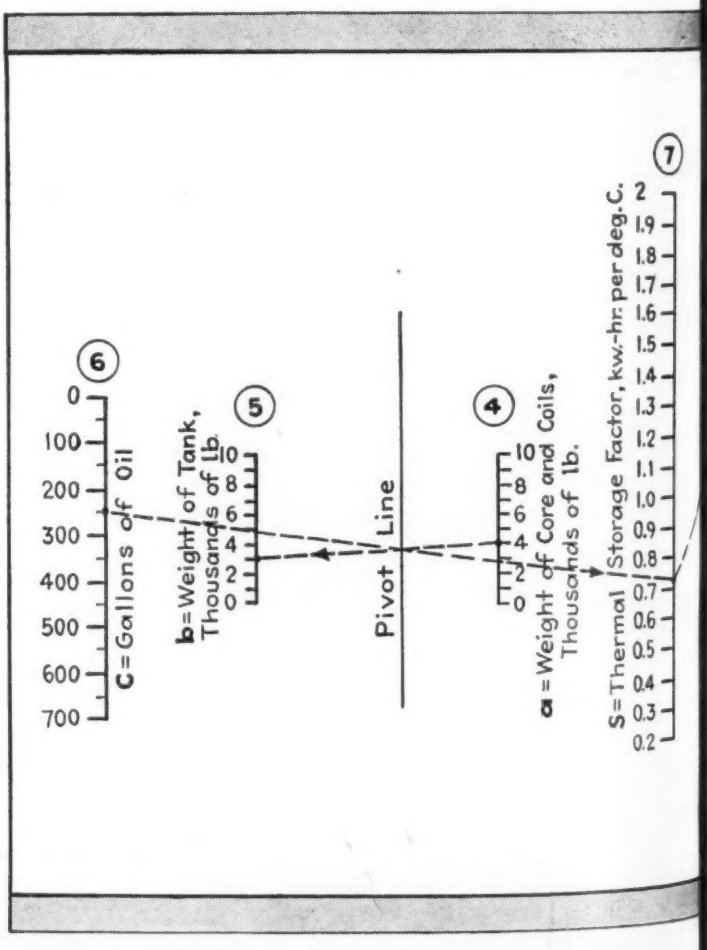
$$S = \frac{3.5\,(a + 0.667b) + 90c}{60{,}000}$$ (See Ref. 1)

a = weight of transformer core and coils in pounds
b = weight of transformer tank and fittings in pounds
c = quantity of insulating fluid in gallons.
H = combined thermal resistance of transformer and vault enclosure in degrees Centigrade per kilowatt

$$H = \frac{\theta_f + K'\,(KW)}{(KW)}$$

θ_f = Transformer top oil temperature rise over surrounding air at rated load in degrees Centigrade
K' = vault heating constant in degrees Centigrade per kilowatt of loss to be dissipated from vault.
KW = transformer loss in kilowatts at rated load and voltage (i.e. core plus copper loss)

Reference (1) "Predetermination of Self-Cooled Oil-Immersed Transformer Temperatures" by W. H. Cooney—A.I.E.E. *Journal*, May, 1925.



Heating Attainment Factor Installed in Vaults

Binghamton, N. Y. (Formerly with Consolidated Edison Co. of New York, Inc.)

ambient air temperature = 26 deg. C.; observed top oil temperature of 500-kva. transformer in vault = 95 deg. C.; transformer operating at continuous rated load; transformer top oil rise at rated load = 45 deg. C.; transformer losses at full load (core plus iron) = 6 kw. Hence effective vault ambient temperature = 50 deg. C. (i.e. 95 deg. C. − 45 deg. C.): effective ambient temperature rise = 24 deg. (i.e. 50 deg. C. − 26 deg. C.): vault heating constant = 4 deg. C. per kw. (i.e. 24 ÷ 6). This value of 4 deg. C. per kw. is fairly typical for the transformer in the example above when the transformer is installed in a vault having 300 cu. ft. of volume and 10 sq. ft. of free ventilating area with earth and other conditions such as obtain in the New York City area.

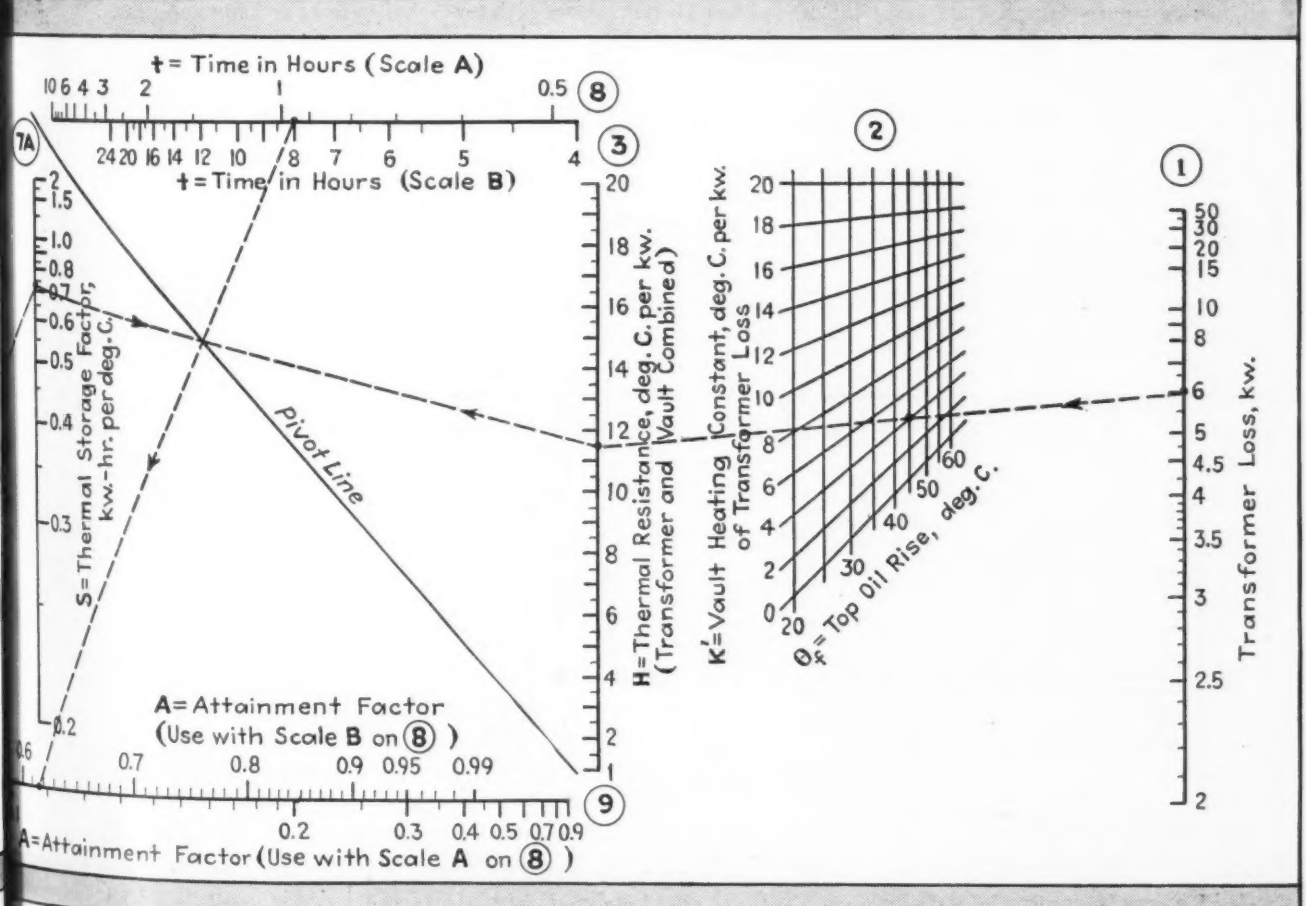
The transformer top oil temperature rise at rated load above its surrounding ambient air temperature (θ_t) may be obtained either from the transformer manufacturer or from tests conducted in an unconfined area such as a large normally ventilated room where the air temperature can be measured with reasonable accuracy. Values of transformer weights, quantity of insulating fluid, and kilowatt loss at rated load may also be obtained from the transformer maker.

Example for Use of Chart

Problem: To determine the 8-hr. heating attainment factor of a transformer when installed in a vault having a heating constant of 4 deg. C. per kw. Transformer top oil temperature rise at full load = 45 deg. C.; loss at full load = 6 kw.; weight of core and coils =4,000 lb.; weight of tank and fittings = 3,000 lb.; quantity of insulating fluid = 250 gal.

Solution: Enter scale (1) at 6 kw. and on scale (2) pass through intersection of θ_t = 45 deg. C. and K' = 4 deg. C. per kw. lines to scale (3) where H is found to be 11.5 deg. C. per kw. Enter scale (4) at a = 4,000 lb. and connect to scale (5) at b = 3,000 lb. Enter scale (6) at c = 250 gal. and pass line from this point through intersection of pivot line and (4)-(5) line to scale (7) where S is found to be the value 0.725 kw.-hr. per degree C.

Locate S = 0.725 onscale (7a) and connect to H = 11.5 on scale (3). Enter scale (8b) at t = 8 hr. and draw line from this point to scale (9) where attainment factor is found to be 0.616.

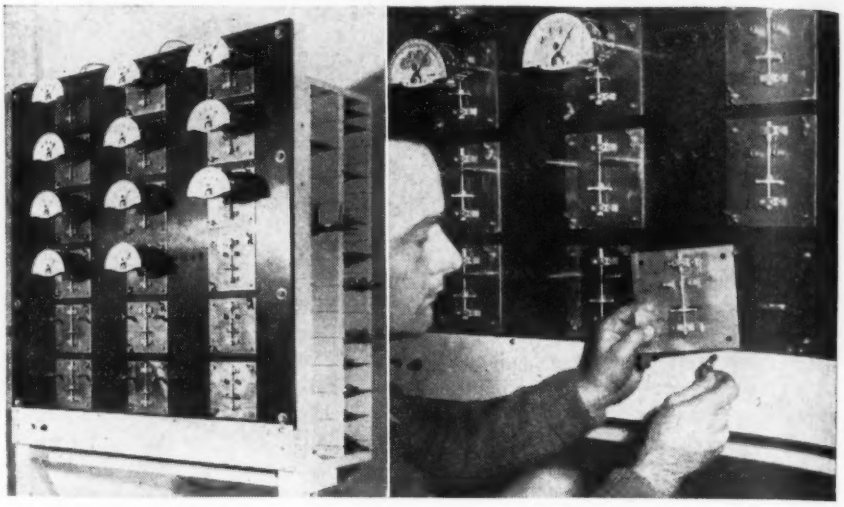

t = Time in Hours (Scale A)
t = Time in Hours (Scale B)
S = Thermal Storage Factor, kw.-hr. per deg. C.
Pivot Line
H = Thermal Resistance, deg. C. per kw. (Transformer and Vault Combined)
K' = Vault Heating Constant, deg. C. per kw. of Transformer Loss
θt = Top Oil Rise, deg. C.
Transformer Loss, kw.
A = Attainment Factor (Use with Scale B on (8))
A = Attainment Factor (Use with Scale A on (8))

Demand Register Checker Has Changeable Adapters

F. A. REDDING, Southern California Edison Co., Los Angeles, Calif.

IN MAKING UP a gang testing board for demand meter registers, Southern California Edison Co. incorporated mechanical simplicity and reliability in addition to flexibility, as exemplified in the equipment illustrated. It consists of a suitable panel with spaces for mounting 18 square steel plates, which plates contain mounting provision and proper drive for registers of all manufacture. Master drive for all plates is provided on the back of the board by a $\frac{1}{10}$-hp., 1,750-rpm. induction motor, with worm drive to a horizontal shaft, which in turn drives three vertical shafts, one behind each row of plates, through bevel gears.

Mounting plates for the registers have a vertical shaft corresponding to a meter shaft, which is gear-driven from the shaft on the back of the board. Diameter of the gear on the mounting plate is determined by the make of the register for which the plate is made. The important thing about speed is that gear ratios must be such that shafts of the adapter plates revolve relatively correctly for the particular makes of registers to be tested. Shaft speeds were made such that at least a two-thirds scale reading on the demand dials will be obtained for the 15-min. demand interval used by this electric company.



GANG TEST BOARD for demand registers—View of complete board (left) showing storage racks for adapter plates for different makes of demand registers. At right is shown how mounting plates are easily changed to accommodate various types of demand registers

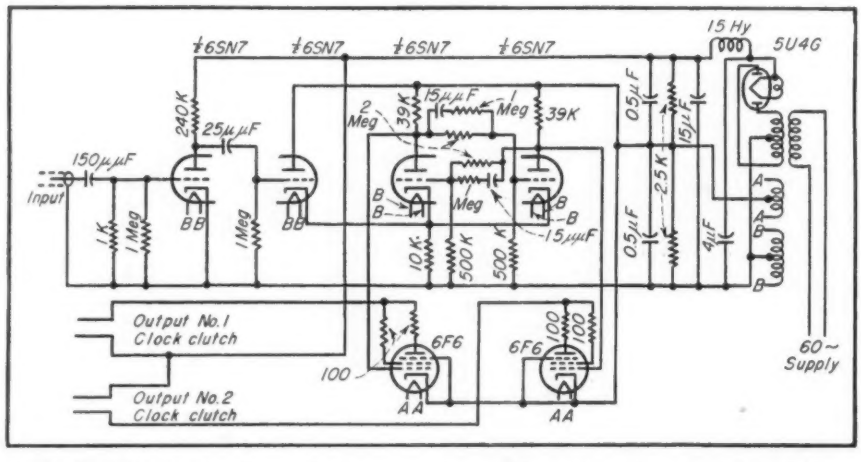
As shown in one of the illustrations, the adapter plates are changeable, being secured to the face of the main board by four studs, diagonal ones being threaded for wing nuts.

• • •

Electronic Switch Measures UV Radiation

TREVOR TEMPLE, Engineer, Sylvania Electric Products Inc., Salem, Mass.

BY THE DEVELOPMENT of a flip-flop switch, provision is made for an accurate means of measuring the time interval between signal pulses as short as three to four seconds produced by a (type SM-200) ultraviolet click meter actuated by radiation from germicidal lamps or other ultraviolet (UV) source. The pulse, supplied by the click meter by means of a cold-cathode, gas-filled triode with grounded cathode, is fed into an RC input circuit of 1,000 ohms resistance and 150 $\mu\mu$f capacity to form a negative pulse of approximately 0.2 micro-second duration.



ELECTRONIC flip-flop switch operates two electric time clock clutches alternately by pulses from ultraviolet click meter. The 6SN7 tube is a double triode

The negative pulse is amplified by a triode resistance coupled amplifier to produce a positive output pulse which is coupled to the cathode resistor of a flip-flop circuit by a cathode follower. When one triode is conducting in the flip-flop circuit the other triode is cut off by the combined effects of cathode bias of the common cathode resistor and the low plate voltage of the conducting tube. The positive pulse momentarily biases both triodes to cut off.

During this period the bias on the two triodes is controlled by the coup-

Lightning Arresters

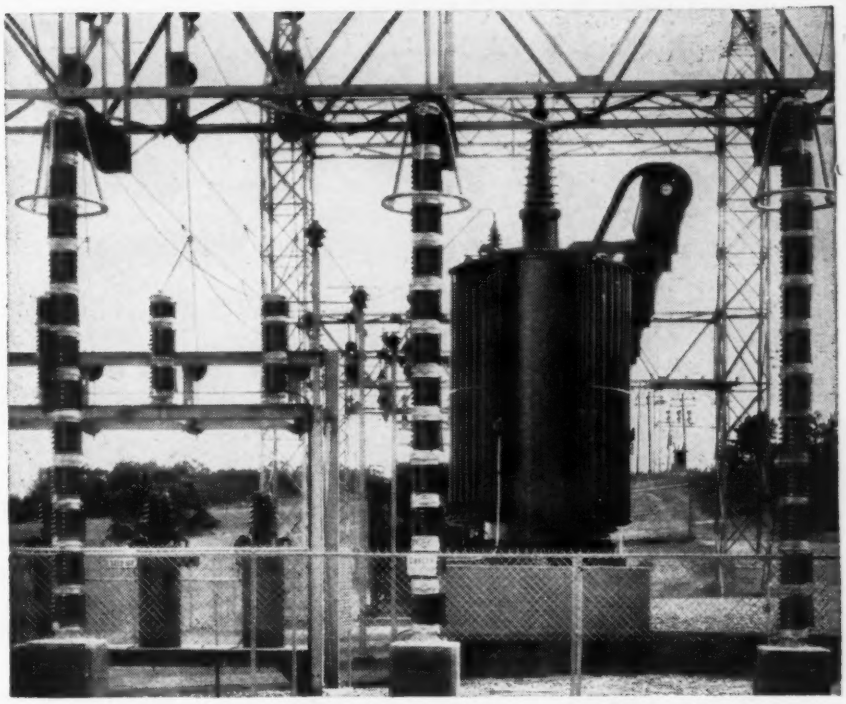
Generating Station and Substations

Thyrite STATION-TYPE Arresters (3 to 242 kv Ratings) Provide:

1. *Exceptionally Large Discharge Capacity*—Easily withstand lightning discharge currents of 100,000 amperes (5 x 10 ms wave). Thyrite valve disks (6 in. dia.) provide a cross-sectional area and thermal capacity unobtainable in any other arrester. The ceramic insulating collar, integral with Thyrite disks, is an exclusive G-E advance for endurance to severe discharges.

2. *Consistently Low Impulse Sparkover*—assured by the preionizing element inherent in the series gap unit of each arrester unit.

3. *Exclusive Interchangeable Unit Construction*—Standard Thyrite arrester unit of 11.5 kv normal rating is *common to all standard system voltages*—23 to 230 kv. Thyrite arresters are a *permanent investment*—interchangeable units are never made unusable by changes in system voltage. For example, the standard 6-unit arrester for 69 kv ungrounded neutral service can be easily modified for 69 kv grounded neutral service simply by removing one arrester unit from each single-pole arrester. The released units are applicable to arresters of other ratings.



FOR PROTECTION OF IMPORTANT POWER STATIONS AND SUBSTATIONS

4. *Performance Unaffected by Atmospheric Conditions*—Gap elements, shunted and shielded with Thyrite and sealed in a separate porcelain container, result in an arrester sparkover voltage which is unaffected by rain, fog, sleet, stray electric fields, or polarity of applied lightning impulse. The small leakage current thru the gap-shunting Thyrite resistors maintains an internal temperature about 3 C above ambient—assuring freedom from atmospheric moisture or internal condensation.

5. *Self-supporting Construction*—requires no bracing insulators—up to and including 121 kv arrester rating. Minimum space for installation—whether on foundations, station structures, mounting brackets or directly on power transformers, permits location of arresters close to apparatus being protected.

6. *Small Physical Size and Weight*—The heaviest part—the 11.5 kv arrester unit weighs only 80 pounds. Usually only a stepladder, and a wrench for tightening bolts between units are needed for assembly. Three-point bolting of standard units avoids straining of porcelains and saves installation labor.

Thyrite station-type arresters provide the *most efficient and enduring* protection for generating stations and substations. Available for standard circuit voltages from 2.3 to 287 kv, they are recommended where either the investment in power equipment to be protected, or the importance of power service continuity, warrant the *highest degree* of protection.

(Assuming even moderate prevalence and severity of lightning, the selection of station-type arresters is usually warranted for protection of power equipment or substations above 1000-kva capacity.)

THYRITE arresters easily meet ASA and AIEE standards for lightning arresters.

For further information on G-E lightning protective equipment for a-c rotating machines, ask for Bulletin GEA-1743; GEA-2978 on THYRITE *line-type* arresters, and GEA-1304 on THYRITE *station-type* arresters. Write to Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

Since THYRITE arresters were introduced in 1930, many thousands of them, on circuits from 2.3 to 287 kv, have established a protection record in service unequalled by any other means of station protection.

GENERAL ELECTRIC

405-23-5600

ling condensers in the plate-to-grid circuits. The grid condenser used with the triode that had been conducting has a greater charge than that of the cut-off triode. Since the negatively charged side of the condenser is connected to the grids, the conducting triode will be held at cut off while the previous cut-off triode will conduct and the circuit will remain flipped over.

Power pentodes, connected as triodes to operate each clock clutch, are fed by the plates of the flip-flop triodes. When one flip-flop triode is conducting, the corresponding power triode will be cut off and its clock stopped. Since only one flip-flop triode can be conducting at one time, each clock will be measuring time or stopped to permit reading.

Stable operation is obtained through the use of a positive pulse of a very short duration since longer pulses permit discharge of coupling condensers between the grids and plates of the flip-flop circuit triodes. Under this condition the conducting triode bears no relation to the triode that has been conducting. Series resistance should be used with coupling condensers in the flip-flop circuit to prevent oscillation.

• • •

Testing Transmission Line Phases

BASIL PAYNE, Engineering Department, NEPSCO Services, Inc., Augusta, Me.

IN TESTING PHASES for the purpose of identifying the phase positions at each end of transmission lines, Central Maine Power Co. and other New England Public Service properties utilize a program set up by the engineering department of NEPSCO Services, Inc., Augusta, to facilitate working at both the control or supply, and the test or remote ends of such circuits. The test procedure follows:

Control or Supply End

I. First Test

a. Ground two line wires.

b. Connect test lamp lead to third line wire, and leave connected. Note this wire as "First Phase," and record its location with respect to the structure. Lamp lead for making tests is made up of two 150-watt lamps in parallel on single wire lead of sufficient length to reach all three phase positions to be tested. Care must be taken to make proper connection to grounded and ungrounded wires of the 115-volt lighting source.

c. As tests are made at remote end lights will glow at about half normal brilliancy. Leave connected until signal of two long and one short flashes is received. Repeat back same signal to indicate end of first test.

II. Second Test

After repeating back signal, connect light lead to one of the other two line wires and transfer the ground connection to the wire first tested. Note position of this wire as "Second Phase:" record and proceed as under first test.

III. Third Test

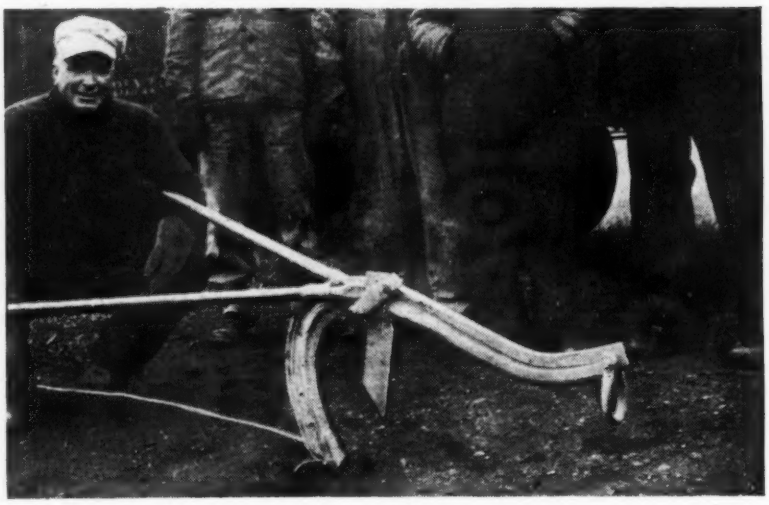
Repeat as above on third line wire and note as "Third Phase," and record. After completion of this test the signal of one short and two long flashes will be given and repeated back to indicate end of test. The line may then be released as far as phase testing is concerned and should be considered by the test men as being alive.

Test or Remote End

I. First Test

a. At scheduled time connect one side of lamp test lead to ground, and with other lead make contact with each line wire in turn until lamps light up with half brilliancy, indicating position of wire being energized from

Ground Trenching Tool Built from Farm Plow

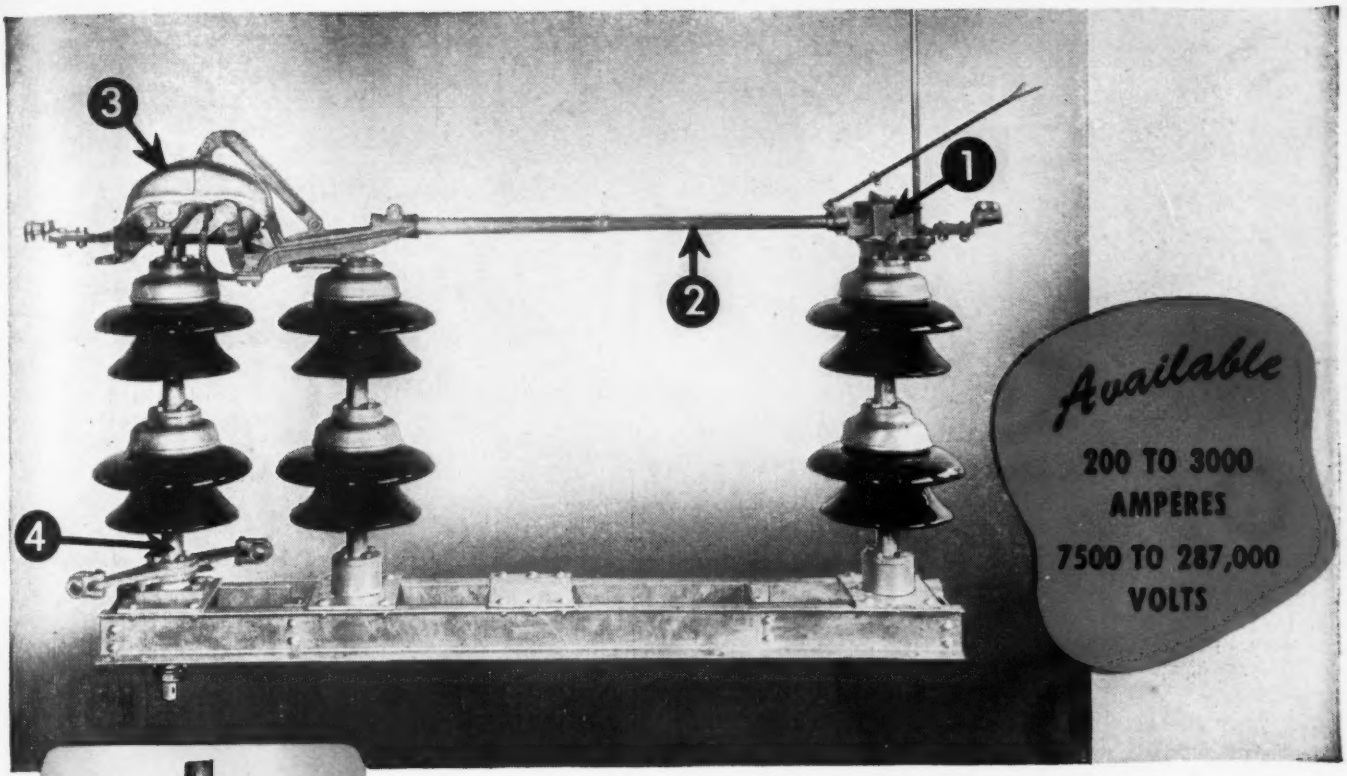


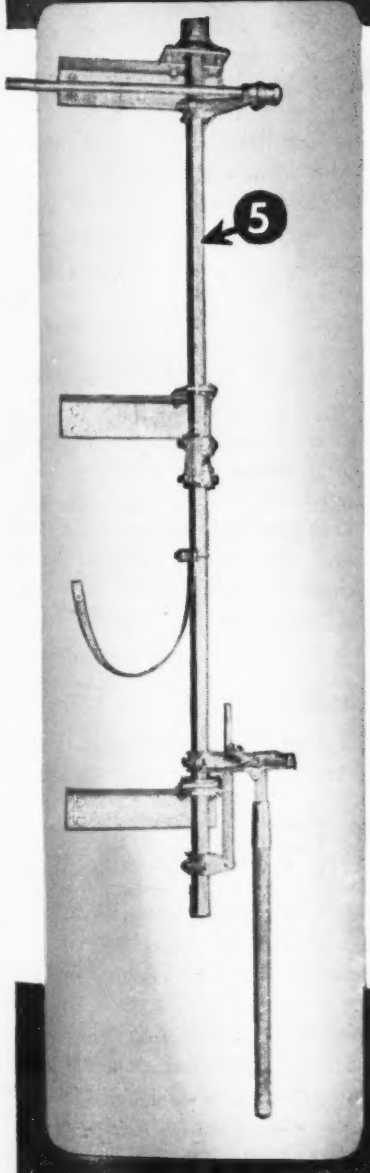
TRENCHING TOOL with a farm plow beam for frame. Handles and attachments were added by line crew

INGENUITY and the materials readily available to the Algoma district line crew of Wisconsin Public Service Corp. were combined to build the trenching tool illustrated. A farmer's plow was used as the frame and the shovel from a cultivator was used for the trench cutter, with a knife coulter attached to cut sod.

An eye welded to the bottom of the plow beam is connected to the wire to be pulled into the trench. Power is supplied from a winch cable and the tool leaves only a slight irregularity in the sod, easily tamped back in place.

Removable handles were made of 1-in. pipe to fit over steel brackets welded to the beam.





FOR "CERTAIN" OPERATION

Anytime . . . under any Condition

specify HI-VOLTAGE

A Hi-Voltage Switch may stay idle for years, but when it is called upon to perform, it operates without any hesitancy. Every user will testify to this "certain" operation. Reasons why are:

1. ***Contact housing*** not only protects the contacts, but also acts as an ice breaker.
2. ***Straight push-pull*** close-open action of switch arm assures most positive opening and closing of switch.
3. ***Completely housed*** operating mechanism with corrosion-proof parts cannot bind or stick. Requires no lubrication . . . never needs adjustment.
4. ***Monel ball bearings*** in stainless steel races, never requiring any lubrication, guarantee that the bearings are ready to operate anytime . . . under any condition.
5. ***Completely machined*** operating shafting adds a definite degree of accuracy and certainty to the switch action.

No field drilling or cutting of parts is required with Hi-Voltage Switches. Their simplicity and ease of installation remove any possibility of improper installation. Time is saved, "certain" operation is assured. Work done at the factory saves hours for the construction crew. After all . . .

IT'S THE INSTALLED COST THAT COUNTS

Recommendations and complete drawings for any installation will be submitted without obligation. Just send a sketch of the substation outline, the proposed location of the switch and the desired location of the operating shaft.

HI-VOLTAGE EQUIPMENT CO.

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Check THESE ADVANTAGES

- **ACCURATE,** because the tuned reed is a natural resonant indicator.
- **DEPENDABLE,** because permanent calibration is a natural characteristic of tuned reeds.
- **STURDY,** because there are no delicate pivots, jewels or moving parts.

and these . . .

EASY-TO-READ vibrating reed-tips form a clearly defined pattern.

LITTLE MAINTENANCE is a result of simple, sturdy construction.

LOW INPUT power is sufficient to actuate the reed comb.

OPERATE IN ANY POSITION without affecting accuracy.

NO WAVE FORM-ERRORS because resonance is a function of the driving frequency only.

INPUT VOLTAGE IS NOT CRITICAL since accuracy is independent of supply voltage.

UNAFFECTED BY EXTERNAL FIELDS as damping effect on natural reed frequencies is negligible.

ORDINARY ROOM TEMPERATURE VARIATIONS HAVE LITTLE EFFECT on calibration.

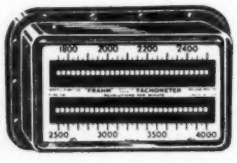
INDEPENDENT OF LOAD, POWER FACTOR OR PHASE SHIFTS on supply circuit.

APPLICABLE TO PULSATING OR INTERRUPTED DIRECT CURRENT as well as to alternating current supply circuits.

Frahm Frequency Meters in switchboard, miniature and portable types are available in various ranges between 15 and 500 cycles per second . . . special requirements up to 1500 cps will be considered. Write today for illustrated Bulletin 1770-W.

"FRAHM" Resonant-Reed TACHOMETERS

. . . operate on the same unique principle as Frahm Frequency Meters except that reed vibration is produced by direct mechanical contact instead of electrically. Available in stationary and portable types . . . for use on turbines, generators, motors, blowers, centrifugal pumps, diesel-electric installations, etc. Various ranges from 900 up to 100,000 rpm. Write for Bulletin 1810-W.



James G. BIDDLE CO.

ELECTRICAL & SCIENTIFIC INSTRUMENTS

1316 ARCH STREET • PHILADELPHIA 7, PENNA.

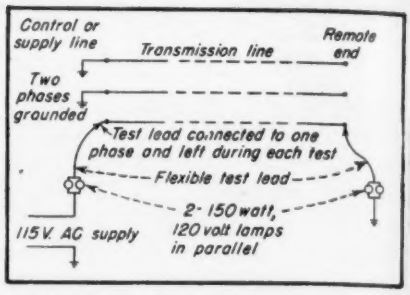

Control or supply line
Transmission line
Remote end
Two phases grounded
Test lead connected to one phase and left during each test
Flexible test lead
2-150 watt, 120 volt lamps in parallel
115 V AC supply

DIAGRAM of connections for testing phases by using two 150-watt lamps in parallel at each end of circuit, supply end and remote end

opposite end. Note this as "First Phase" and record position. Give signal of two long and one short flashes to indicate end of test and maintain contact until confirming signal is received.

II. Second Test

After interval of about 5 minutes to allow for changes at supply end, repeat as for first test, noting and recording as "Second Phase."

III. Third Test

Repeat as above, noting and recording as "Third Phase." At end of this test send signal of one short and two long flashes to indicate end of test; then maintain contact until confirming signal is received from opposite end.

Two of the three line wires are grounded in each test; but to provide maximum insurance against possible potentials from static or induction, it is suggested that all tests be made by men wearing rubber gloves, and that test connections be made by wires attached to switch sticks.

During any given test, care must be taken to avoid making any series of flash signals which might be mistaken for the "test completed" signal.

•

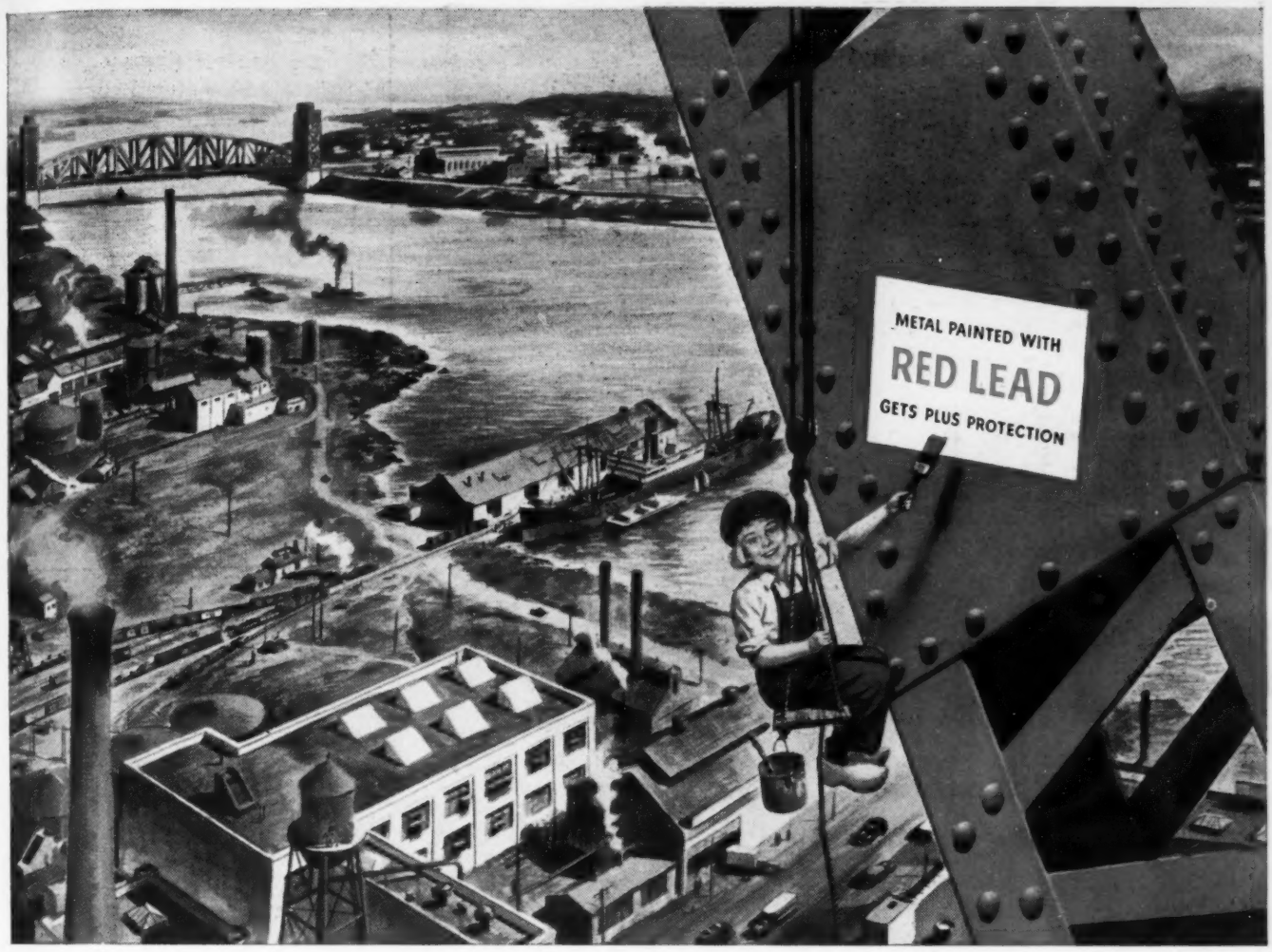
Rebuilding 44-Kv. Line For Static Installation

J. A. SAYRE

Transmission Engineer
Iowa Power & Light Co.
Des Moines, Iowa

OFFSET crossarm construction, with the configuration shown in the accompanying sketch, has permitted rebuilding 44-kv. lines with overhead static at 30-deg. shielding angle and without replacing the original line with higher poles.

A 5-ft. 6-in. crossarm is used at the top, and the static grounding wire at every pole is carried clear of the



Unique RED LEAD "Soaps" ... check Rusting 3 Ways

Scientific research shows why Red Lead has long been regarded as the "standard" metal-protective paint.

One interesting factor is Red Lead's ability to react with the vehicle and produce unique lead "soaps."

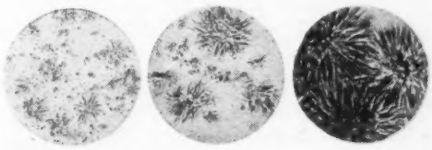
These "soap" formations grow to form a tough, impervious, intermeshing matrix within the paint film, as shown in the photomicrographs below. These "soaps" help Red Lead inhibit rust three ways.

1. Toughen Paint Film. Radiating from central cores the "soap" formations develop long, rod-like projections, which spread out and interlock. Thus, they form a dense intermeshing structure that *mechanically* reinforces and toughens the paint film.

2. Make Film Water-Resistant. The very structural formation of these "soaps," with their thick, impervious matrix of closely-knit fibres, helps restrict the passage of moisture through the paint film. And metal cannot rust without the presence of moisture.

3. Keep Film Flexible. The "soap" formations, far from being rigid, allow movement all along their soft, intertwining projections. The resulting flexibility helps prevent the ruptures to which a hard, unyielding paint film is subject. Thus the lead "soaps" aid in maintaining the continuity of the paint film.

Lead "soaps" form primarily in the dry paint film as it ages. This is where the "soap" formations impart their greatest benefits. When a paint film weathers and ages, decomposition products of the vehicle are formed. Red Lead's ability to slowly combine with these decomposition products actually enhances the life of the paint film. Red Lead's slow rate of reaction means the film age-hardens at a slower rate. It thus retains a high degree of flexibility, a great factor in its lasting adhesion.



The photomicrographs above show how Red Lead "soaps" progressively spread out as they grow and thus reinforce the paint film.

Remember, too, Red Lead is compatible with practically all vehicles commonly used in metal protective paints, including fast-drying resin types.

Specify RED LEAD for ALL Metal Protective Paints

The rust-resistant properties of Red Lead are so pronounced that it improves *any* metal protective paint. So, no matter what price you pay, you'll get a better paint if it contains Red Lead.

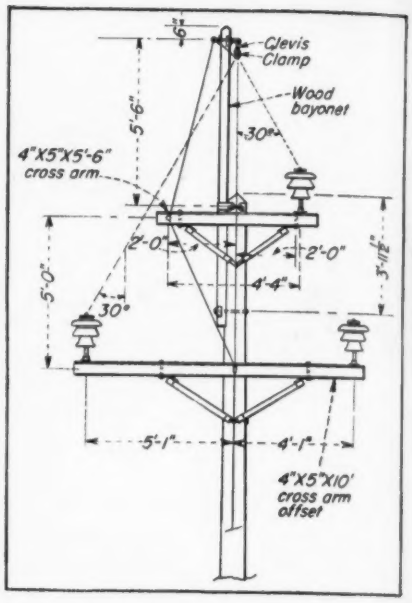
* * *

The benefit of our extensive experience with metal protective paints for both underwater and atmospheric use is available through our technical staff.

NATIONAL LEAD COMPANY: New York 6; Buffalo 3; Chicago 8; Cincinnati 3; Cleveland 13; St. Louis 1; San Francisco 10; Boston 6, (National Lead Co. of Mass.); Philadelphia 7, (John T. Lewis & Bros. Co.); Pittsburgh 30, (National Lead Co. of Pa.); Charleston 25, W. Va., (Evans Lead Division).

DUTCH BOY
Reg. U. S. Pat. Off.
RED LEAD

KLEINS
FOR MEN WHO
WANT THE BEST
Every good workman appreciates high quality in the tools and equipment he uses. To a lineman, however, this regard for quality is more than admiration for fine craftsmanship. The lineman daily trusts his very life to his safety strap, belt and climbers—and under such conditions high quality is more than a matter of pride.
Good workmen know that there's no substitute for experience. It is the years of expert craftsmanship back of every piece of Klein equipment that make Klein belts and safety straps—Klein climbers and grips—Klein pliers and wrenches the first choice of linemen today as they have been "since 1857."
ASK YOUR SUPPLIER
Foreign Distributor: International Standard Electric Corp., New York
This book on the care and safe use of tools will be sent on request.
Since 1857
KLEIN TOOLS
Mathias KLEIN & Sons
Established 1857
Chicago, Ill., U.S.A.
3200 BELMONT AVENUE, CHICAGO



WOOD BAYONET carries static 5 ft. above pole top and offset lower arm gives 30-deg. shielding angle

upper arm hardware by an attachment to the outer end of the arm. The static wire is carried on a 10-ft. wood bayonet strapped to the pole to extend 5 ft. above the top. A 10-ft. crossarm is offset 6 in. to bring both lower conductors within the 30-deg. angle.

Performance with this construction has been comparable to newer lines with modern shielding design.

•

Not-at-Home Device Records Phone Messages

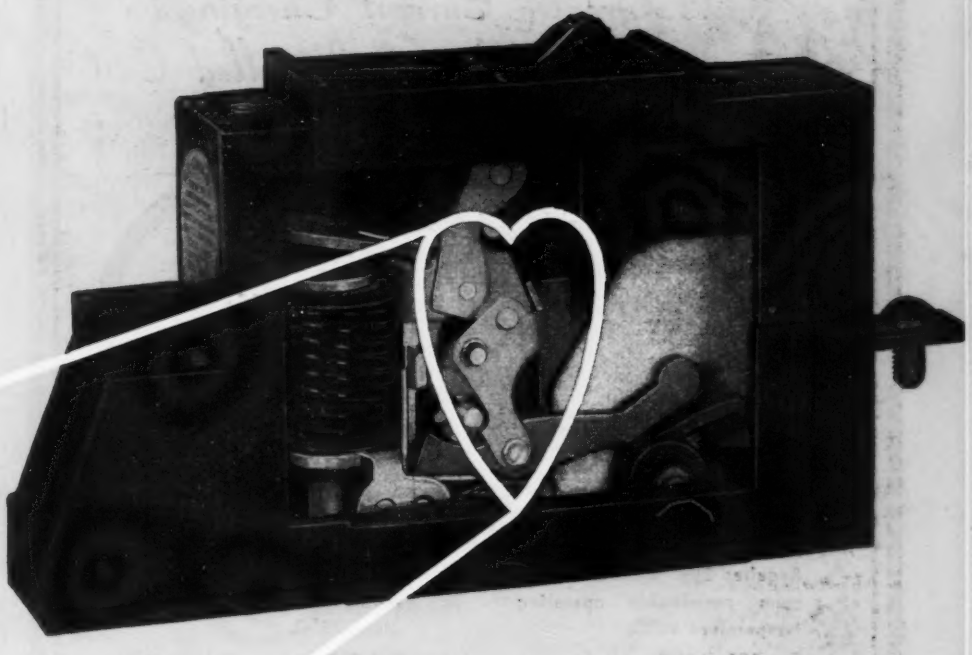
Swiss telephone subscribers are now enabled (at an extra charge of $50 monthly) to have incoming messages recorded for their benefit when there is no one at home to answer. The Ipsophone not only does this but will repeat the message to the subscriber if he calls his home from wherever he happens to be and goes through a prescribed code procedure. The messages can, of course, be heard through the ear part of the conventional telephone when the subscriber returns home.

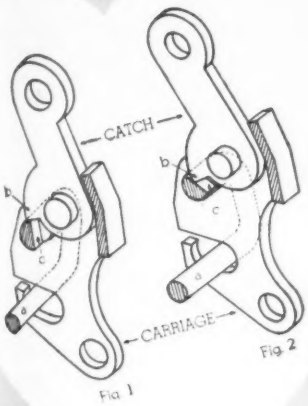
Wire Recorder

The Ipsophone is a magnetic-wire recorder. It is supplemented by a recording which tells the telephoner at the other end that the receiving subscriber is away but that the message will be recorded (up to 30 minutes' worth). When the recipient wants to

this HEINEMANN MAGNETIC CIRCUIT BREAKER

bares its Mechanical Heart





This MECHANICAL HEART
(or Latch Mechanism) does double duty . . .

No. 1 *It opens breaker with least mechanical delay . . .*

When the armature engages the lower leg of the lock (a) it rotates the lock enabling the tooth of the catch (b) to pass through the cut portion of the lock (c), thereby breaking the toggle and releasing the contacts which are under heavy spring pressure. *Of all known latches, this mechanism operates with the least amount of friction.*

No. 2 *It opens breaker independent of handle operation.*

The relative position of the catch to the carriage remains the same as in Fig. 1 whether the handle is in the "on" position or turned to the "off" position, when the contact is broken manually. The latch collapses only under overload or short circuit conditions—*and it does that even if the handle is purposely held in the "on" position.* Fig. 2 shows the latch on its way to the collapsed position.

EST. HEEO 1888

HEINEMANN ELECTRIC COMPANY

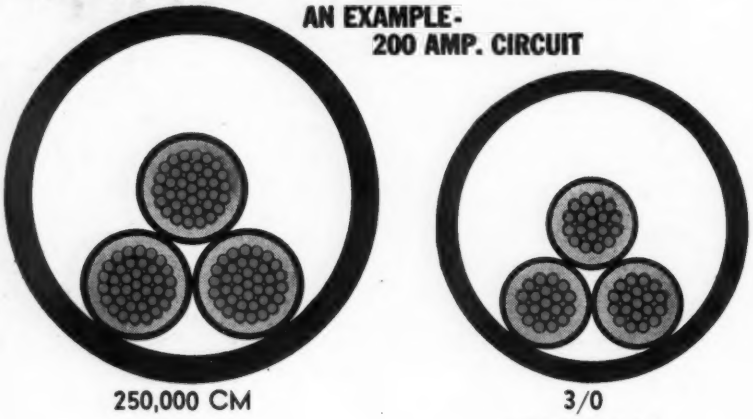
Established 1888

103 PLUM STREET TRENTON, N. J.

CRESCENT
ENDURITE
Type RH

Gives Greater Current Carrying Capacity per Dollar of Installed Cost

AN EXAMPLE-
200 AMP. CIRCUIT



250,000 CM

TYPE R

Requires 2½" Conduit. Maximum permissable operating temperature 60°C.

For 100 ft run, cost for wire and conduit — approximately

$159.00

3/0

TYPE RH

Requires 2" Conduit. Maximum permissable operating temperature 75°C.

For 100 ft run, cost for wire and conduit — approximately

$116.00

Both figures are based on 330 feet of cable and 100 feet of galvanized steel conduit at PRESENT LIST PRICES. Saving shown—27%.

The superior heat resistant characteristics of CRESCENT ENDURITE INSULATION with its higher permissible operating temperature and therefore greater current carrying capacity, permits the use of a smaller size of conductor, and in most cases smaller size of conduit at less cost than would be required for Type R Wire for the same load.

For light loads requiring small sized conductors, Voltage Drop is the determining factor in choice of wire size. Usually in sizes No. 6 AWG and heavier for power circuits or No. 1 AWG and heavier for lighting circuits, CRESCENT ENDURITE Type RH Wire & Cable gives the lowest installed cost-per-ampere of useful circuit capacity.

CRESCENT

WIRE and CABLE

NEMA

CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, NEW JERSEY

hear the message he simply says "Hello" twice and then, for the sake of secrecy, gives a code number with pauses that will only unlock the apparatus for repetition of the message if it is the one present on the instrument.

Any spurious code number will only elicit the "busy" signal. Speaking the word "cancel" twice into the Ipsophone automatically obliterates the recording and the equipment is ready for new messages. The wire is controlled so as not to advance when the speaker stops speaking.

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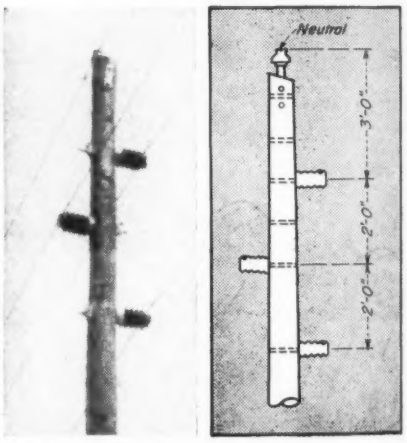
Side Mounting Thwarts Impulses and Tree Limbs

H. L. HESS

Engineering Department
Public Service Co. of Indiana, Inc.
Indianapolis, Ind.



CROSSARMLESS construction affords maximum lightning protection and minimum tree trouble for 11-kv. line at low cost. Diagram shows phase and ground wire spacing

VERTICAL CONFIGURATION without crossarms as shown in the accompanying illustration gives an economical means of providing maximum lightning protection and a minimum of tree clearance trouble. Pole pins replace the conventional crossarms in this 11-kv. line construction.

The overhead ground wire is carried on a pole top pin insulator and is grounded at every pole. Post type insulators rated 25 kv. are mounted on through bolts, with 2-ft. spacing. Increased span clearance is provided with the center conductor on the side opposite the upper and lower conductors.

DIGESTS

Condensations and abstracts of articles in the foreign press, committee reports, unpublished papers before numerous technical societies, research bulletins, standards.

Steam Power Plant Corrosion Problems

From an article by J. A. Keeth (Kansas City Power & Light Co.) in "Corrosion," Houston, Texas, June, 1946.

SOURCES of corrosion in power plants may be grouped into six general classifications, with some overlapping:

1. Gases held in the liquids, primarily oxygen and carbon dioxide, but occasionally others, form one of the most common causes of corrosion. Pitting of drums, tubes and pipe lines and general corrosion of condenser tubes are usual manifestations. Mechanical removal of the gas is the recognized cure; sodium sulphite is added occasionally. Protective paints are of doubtful value. Attack on brass and copper condenser tubes by ammonia in the steam may cause failures from corrosion fatigue before general weakening. Removal of ammonia from the makeup water is the obvious but difficult remedy, but design of the condenser has a definite bearing on the corrosion.

2. Dissociation of steam, a factor of considerable importance in large high-temperature boiler installations and water-cooled furnaces, is caused by sluggish circulation at points of high heat application. The oxygen combines readily with the iron surfaces to form magnetic oxide, a poor heat conductor, resulting in cumulative over-heating and rapid failure. Free hydrogen also is capable of causing destructive attack. The solution is in correcting the water circulation.

3. Damage by corrosive stack gases is most prominent with economizers and air preheaters when the temperature falls to the dew point and sulphurous or sulphuric acid forms, causing leaks, particularly in joints. Designs that keep the gases above the dew point are the best remedy, while removal of ash and soot from the surfaces results in higher actual temperatures when going on or off banks.

4. Furnace gas and slag in pulverized-coal furnaces may cause rapid "washing away" of waterwell tube surfaces. Maintenance of an oxidizing rather than a reducing atmosphere adjacent to the tubes is effective, and coatings also are of some help, although no final answer has been found.

5. Corrosion fatigue of condenser tubes and furnace waterwell tubes, already mentioned, also may occur in economizers and boiler drums. Redesign of water-column connections and conducting feedwater through a sleeve where it enters the boiler drum have relieved the trouble.

6. Corrosion erosion inside the cases of centrifugal boiler feed pumps operating at 1,000 to 1,800 psi. is usually most severe at points of highest water velocity or turbulence. Low pH seems to be a contributing factor, though not too much is known about the exact causes. Use of stainless steel or monel metal for affected parts seems the best solution.

7. Besides the types of corrosion considered in detail miscellaneous sources include graphitization of cast-iron parts, copper-plating of boiler drums and tubes, effects of corrosive liquids, electrochemical action and embrittlement.

Electrified Hotel Kitchen

From an article by H. Ledermann in "Elektrizitäts Verwertung," Zurich, Switzerland, January-February, 1946.

APART from low operating cost, electric power in the hotel kitchen does away with transport of solid fuel or burning of gas, eliminates smoke and soot, requires no exhaust flues and reduces the room temperature. Choice and disposition of the various appliances depend on experience, and care must be used in each installation to utilize fully the advantages of electric service.

Costs per guest go down rapidly as the number served increases. Individual electric devices involve a higher capital cost than ranges with ordinary cooking utensils, but the higher efficiency of the former justifies their use when more than a few persons must be served.

Electrification of a fuel-burning kitchen involves fundamental changes in the ventilating system. A fuel-burning stove consumes much air and heats its surroundings. The air must be renewed 10 to 20 times per hour. In an electric kitchen there is no combustion and little heat is given out. Vapors from cooking may saturate the air and cause condensation, so that some forced ventilation may be needed.

Refrigerators may be located in convenient places, since the lower temperature of the kitchen reduces the need for isolation of cold rooms in order to cut operating cost.

Materials for Gas Turbine Units

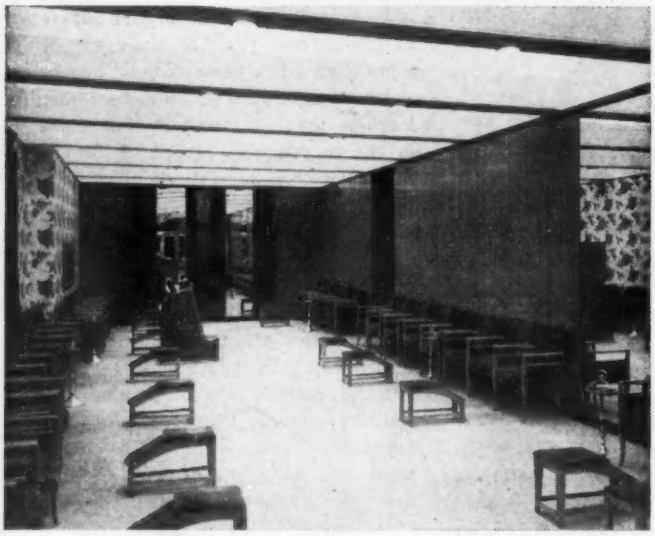
From a paper by Arthur D. Hughes (Allis-Chalmers Mfg. Co.) presented before the American Society of Mechanical Engineers, Detroit, June 17-20, 1946.

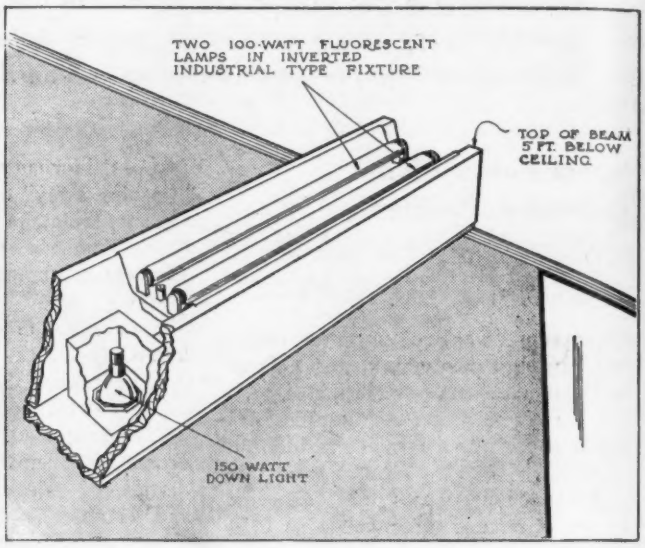
MATERIALS and designs for gas turbine power plants must eventually permit reliable operation at turbine inlet temperatures up to 1,500 deg. F. or better. With this in view several experimental gas turbine units have been designed and tested. Research with full-scale equipment seems expensive and takes much time, but it is difficult to obtain conclusive data on the subject in any other manner. Breaking up the research into tests of component parts may be cheaper, but is not always feasible. So many auxiliary units might be required to duplicate desired test conditions that the complete power plant might as well be used.

Fundamentally there still is a definite need for a satisfactory and accurate method of obtaining the average temperature of gases hotter than 1,200 deg. F. at high velocities and pressure. Balancing of multiple combustion chambers so that each carries its share of the flow and delivers to the turbine hot gas at relatively the same temperature is difficult. Often apparently identical combustion chambers show wide variations in performance.

LOAD BUILDING

Outstanding Example of Modern Store Lighting





DROPPED beam lighting below vaulted ceiling provides 135 foot-candles for shoe fitting

NOVEL and eminently practical features are included in the lighting installed in the new store of the Miller-Taylor Shoe Co. at Columbus, Ga. One feature is the pushbutton control at the entrance to the store. Lights in the windows and in a large troffer in the front of the store are on a time switch. If the evening window shopper wants to see the rest of the store he pushes a button on the door frame. A contactor then goes to work and lights up the whole first floor of the store for as long as the button is held down.

Another feature is the dropped beam lighting installed in one department, which is illustrated in the accompanying picture and sketch. The bottoms of the beam are 10 ft. above the floor and their tops are 5 ft. below the ceiling. Each beam is a trough in which are inverted 235-watt, industrial type RLM, 2-lamp fixtures in continuous row. Set into the bottom of each beam are two 150-watt, R-38 spot lamps for down lighting. The beams are on 8-ft. centers and the vaulted ceiling above them is bone white plaster. This fixture and lamp assembly was designed by Georgia Power lighting engineers.

Throughout the store is a carefully engineered combination of fluorescent and incandescent lighting, making large use of troffers, coves, spots, floods and decorative effects, the whole comprising 263 fixtures and amounting to 29.4-kw. connected load with an EAR of $1,621.50. Proud of the job are those who cooperated in it; the store owners, the architect, Jas. J. W. Biggers; and J. B. Browder and his associates of the lighting sales staff of the Georgia Power Co.

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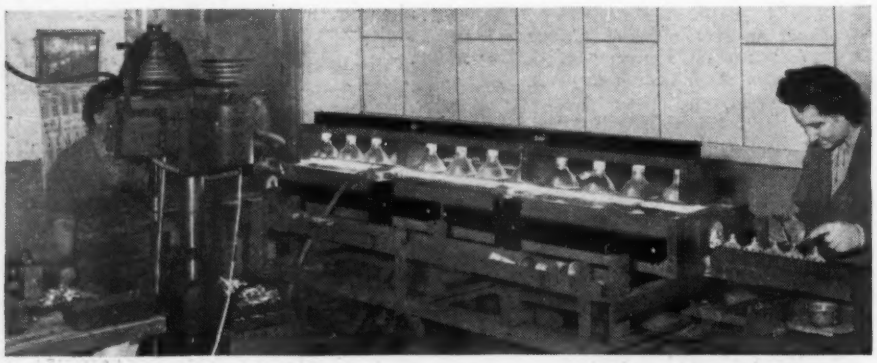


SOLDERING TEMPERATURE of 500 deg. is supplied by 12 kw. in infrared heating for soldering adapters to refrigerator valves. Production was stepped up 11 percent with one less operator

Infrared Speeds Soldering Operation

SOLDERING of adapters to brass refrigerator valves is accomplished at the Deutsch Co. of Los Angeles by use of 36 infrared lamps as shown, with connected load of 12 kw. These 375-watt, R-40, Fostoria lamps are mounted in a No. 40-000 series, Even-ray section as close as possible to the valves to provide the 500 deg. F. required. The operator places the valves on a conveyor as the adapters are as-

"LVR" ENGINEERING makes it easier to sell ENGINEERED LIGHTING

✻ FOR STORE INTERIORS

Albrecht's Cut-Rate Drug Store in Cleveland uses Spero "LVR" Luminaires for efficient interior lighting.

Spero "LVR" meets the three basic requirements for good "engineered lighting"—high efficiency, low maintenance, and smart appearance. Light from the 40 W tubes is shielded by evenly spaced louvres. Individual reflectors, removable for easy maintenance, provide a reflecting surface for each tube. Reflecting surfaces are finished in "Plastox" white (86% Reflection factor).

Starters can be replaced without disturbing either the tubes or the hinged louvres. Relamping is done from the top, on pendant-mounted units, and by swinging down the louvre on surface mounted units. Plastic side panels add to the appearance and utility of this fixture. Available with instant-start ballasts.

Write for complete engineering data.

Spero also manufactures REFLECTORS, FLOODLIGHTS, VAPOR PROOF UNITS, and various MATERIALS FOR ELECTRICAL CONSTRUCTION. Write for Bulletin No. 10.

A TYPICAL EXAMPLE OF "FUNCTIONAL" LIGHTING

FACTS and FIGURES

Area—3000 square feet. Height of ceiling—12 feet.

Color Scheme—Ceiling and walls—buff colored acoustical board.

Fixtures—43 Spero "LVR-448" Fluorescent Luminaires. 3 PAR 38 Spot Units.

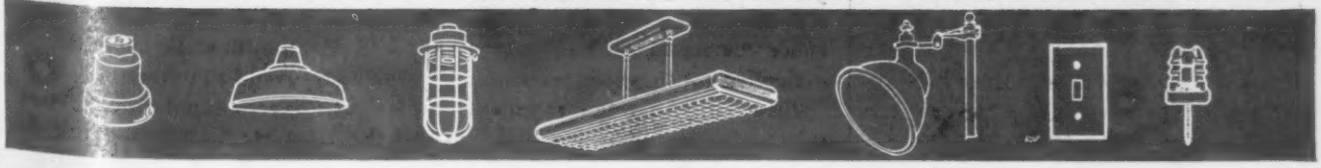
Layout—Continuous rows follow store arrangement to provide desired glare-free intensity on counters and lead customers to store displays. Spotlights highlight island displays.

Result—Average Footcandles on counters 36; on displays 87.

Engineered and installed by the Reserve Electric Company, fixtures sold through the Frankelite Company.

✻ ***One of a series. Other advertisements will show "LVR" "engineered lighting" in offices, institutions, etc.***

The SPERO ELECTRIC CORP. 18222 LANKEN AVE. CLEVELAND 19, OHIO



An Amazingly Convenient New Kit of

Wedge-Grip Connectors

"WEDGE-GRIP" KITS

The Connector of A Hundred Uses

The Wedge-Grip is a splendid connector for fixtures, junction boxes, service entrance, outlet boxes, small and large motors, electric ranges, etc.

Here's a handy kit that slips into the electrician's tool bag, and provides the right size Sherman Wedge-Grip Connector for No. 18 through No. 2 standard wire. A marvelous time saver. Eliminates those bothersome, slow soldered splices.

Kit contains 55 high quality Wedge-Grips, made of pure, hard drawn copper, with oval pointed bronze screws that wedge wires securely between V-shaped corrugations. Screws have slotted hex heads.

Order a stock of these new Wedge-Grip Kits today!

H. B. SHERMAN MFG. CO.
BATTLE CREEK, MICH.

Sherman

ELECTRICAL CONNECTORS

sembled. The conveyor carries the parts through the tunnel in a 15-min. cycle, and as they emerge, an operator applies the flux and solder. The valves are then placed in slots in a tray, the excess flux removed, and they are ready for further processing.

Prior to the installation of the infrared, four operators with small torches were required to solder 180 units per hour. Production was increased to 200 pieces per hour with three operators, more uniform results are secured, and there is no objectionable tarnishing of the parts, with resulting drop in rejects.

•

Newspaper Advertising To Commercial Customers

DAVID MARKSTEIN
New Orleans, La.

BELIEVING that in trying to sell retail stores on the idea that better lighting can provide a sales promotion shot in the arm, it is as important that individual salespeople be convinced as store executives, New Orleans Public Service, Inc., is currently running its "better light-better selling" campaign in newspapers. The wide-range medium was chosen deliberately over more intensive media such as direct mail which are usually employed for selling a selected list.

Before the war the utility had put on a continuing campaign to sell its better lighting story. Direct mail was used almost exclusively. This advertising was necessarily curtailed during the war when shortages made it impossible for merchants to buy needed equipment, and when the time came to resume the campaign, Public Service faced a decision.

On the one hand, direct mail could have been used exclusively as it had been before the war, when letters, folders and other selling messages were directed to executives of retail stores.

But Jim Amoss, Public Service advertising manager, had an idea that decisions on such matters were often made in the ranks and passed up to store management in the form of suggestions or complaints that "We can't sell the dresses off that display because customers can't even see them —they've got to be lighted better."

Reasoning that the experience of salespeople on the job would be a factor in every merchant's final decision, Amoss plumped for "shotgun" rather than "rifle" advertising, which would reach all ranks in the prospect stores.

Sell in the Dark?

A typical ad in the present newspaper campaign was headlined "Could you sell a dress in the dark?" Illustration showed a salesgirl holding up a dress by candlelight. The body copy continued: "Or for that matter could you sell anything in the dark—a watch, a washing machine, a cauliflower or even a sandwich?"

Supplementing the newspaper campaign is some direct mail. In this the newspaper ads, reproduced full size, are directed to top executives of stores.

Since a sweeping decision such as that to rewire an entire store is not made quickly, and since Public Service itself sells no lighting fixtures or appliances (store owners must go for these to lighting contractors), there is no yardstick by which the decision to use newspapers for intensive selling can be measured. The utility's executives are so convinced of the campaign's worth, however, that plans are to continue it indefinitely in the present form.

•

Soil Cable Warms Poultry House Water

ON AN EASTERN POWER SYSTEM the rural service department recently made an application of soil heating cable to henhouse water supply piping which solved a serious problem of the water freezing under winter conditions. There were about 4,000 laying birds in the poultry house, and formerly the water froze in the line several times each cold season. The house was served by about 2,100 ft. of ½-in. galvanized iron pipe.

A study of the local conditions indicated that if 300 ft. of this pipe located in the coldest section of the run were wrapped with cable under control of a thermostat connected with a thermocouple inside an outer covering of asbestos surrounding the pipe, and the thermostat set to turn on current at 28 F. and cut it off at 33 F., the flow through the entire supply would not freeze.

The energy input was 1.2 kw., and the complete installation cost about

16,000-kva, 110,000 to 13,800 volts, water-cooled single phase, 60 cycle, Wagner Power Transformer.

Silent Servants at Bonneville

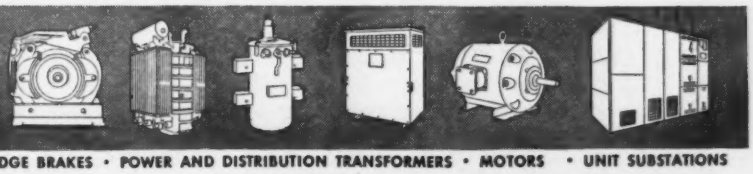
Power transformers are "silent servants" essential for the unfailing transmission of power so that factories, hospitals, schools and homes may have a continuous and dependable flow of electricity for every need. The Wagner transformers installed at the Bonneville Dam and at many other points along the 2700 mile high-voltage Bonneville-Grand Coulee system are giving unfailing service. Wagner power transformers are dependable because they are liberally designed with extra factors of safety, constructed of carefully selected and pre-tested parts, and are skillfully engineered, built, and tested.

Utility companies will find it to their advantage to consult Wagner on their next power transformer installation. Wagner transformers are built to maintain a reputation for quality established in more than fifty years of dependable service to the power industry. Users of Wagner transformers also profit by our quick, convenient, nationwide service facilities.

Any of our twenty-nine branch offices, located in principal cities, is ready to help you. These offices are manned by trained field engineers who will gladly give you the information you need in completing your next transformer installation. Write for Bulletins TU-180 and TU-181 on the complete transformer line. Address Wagner Electric Corp., 6456 Plymouth Avenue, St. Louis 14, Mo.

Consult Wagner Engineers on All Transformer Problems

Wagner Electric Corporation
EST. WE 1891



T47-5

BRIDGE BRAKES • POWER AND DISTRIBUTION TRANSFORMERS • MOTORS • UNIT SUBSTATIONS

ELECTRICAL AND AUTOMOTIVE PRODUCTS

EC&M CUBICLE-TYPE STARTERS

for SYNCHRONOUS MOTORS

STANDARD 2300 AND 4600 VOLT STARTER WITH DISCONNECT SWITCHES

STANDARD 220-550 VOLT STARTER WITHOUT DISCONNECT SWITCHES

Complete Units -- Push Button Operated

with automatic field application by Polarized Field-Frequency Relay

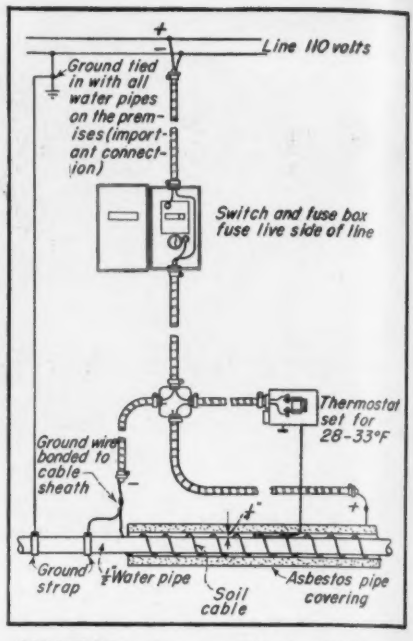
WITH all internal wiring complete, and totally enclosed, these EC&M unit-type Synchronous Starters provide a quick, low-cost installation. They are shock-proof and do not require an expensive control room. Mounting them out in the plant, alongside the motors they control, keeps the length of heavy cable between motors and starters at a minimum, particularly those designed for reduced voltage starting.

All starters are of the push button, magnetic type arranged to start the motor as a squirrel-cage motor, and then apply direct current field excitation when the motor has attained a speed most favorable for synchronizing. The Polarized Field-Frequency Relay operates *automatically* to pull the motor into step without pole slippage, with minimum current and maximum synchronizing torque.

Being sensitive to motor speed, the relay also operates to remove the field, should the motor pull out of step due to a dip in voltage or to an overload. If the motor has adequate torque to re-accelerate the load up to synchronizing speed, re-synchronization occurs automatically.

Write for Bulletins 1075-B, 1076-B, 1077-A and 1078-A

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79th STREET • CLEVELAND 4, OHIO


+
−
Line 110 volts
Ground tied in with all water pipes on the premises (important connection)
Switch and fuse box fuse live side of line
Thermostat set for 28-33°F
Ground wire bonded to cable sheath
Ground strap
Water pipe
Soil cable
Asbestos pipe covering

METHOD of connecting soil heating cable to water pipe serving poultry house to prevent freezing

$80. While the seasonal energy consumption was highly variable, depending on the incidence of sub-freezing temperatures and their duration, the service was an addition to other farm uses and relieved the poultryman from much trouble.

•

Induction Heating Show Draws 2,000 in St. Louis

INTEREST in dielectric and induction heating was recently stimulated in St. Louis by a three-day exhibit and series of meetings. Arranged by Union Electric of Missouri, and with eleven manufacturers of equipment participating, the show drew an attendance of about 2,000 invited guests representing local power users.

Actual demonstrations were made of many new operations possible with this method of electric heating, including surface hardening, brazing, dehydration and bonding of plastics and wood. Booth displays and demonstrations were continuous from 2 to 10 p.m. daily during the show, and lectures were given by several recognized leaders in application of induction heating to industrial processes.

Admission to the exhibit and lectures was by ticket only. Union Electric Co. believes that these meetings were helpful in ideas for production methods and will produce new load over a period of time as the new ideas are put into practice.

Heat and Corrosion Can Skyrocket—

WIRING COSTS!

ROCKBESTOS A.V.C.

KEEPS 'EM DOWN TO EARTH

"Keep the circuits operating and forget the expense" might have been a justifiable slogan during the war—but now that cost-conscious management expects economy in maintenance no power company or big manufacturing plant can afford to overlook the re-wiring eliminators in the Rockbestos A.V.C. line.

If heat-exposed circuits to exhausters, precipitators, valve controls, draft fans, slush and feed pumps aren't holding up—remember that Rockbestos A.V.C. wires and cables won't bake brittle, crack or flow even under 230°F. operating temperatures. If corrosive fumes, grease or oil are shortening wire life—remember that impregnated asbestos won't rot or bloom. And don't forget that Rockbestos A.V.C. also resists conduit condensation resulting from heating and cooling cycles.

Take re-wiring expense out of circuit maintenance with Rockbestos A.V.C.—in 600 to 5000 volt ratings, including single and multi-conductor power cables, control cables and lead sheathed or armored constructions. Write for a catalog.

ROCKBESTOS PRODUCTS CORPORATION
208 Nicoll St., New Haven 4, Conn.

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

NEW YORK BUFFALO CLEVELAND DETROIT
PITTSBURGH CHICAGO ST. LOUIS LOS ANGELES
SAN FRANCISCO SEATTLE PORTLAND, ORE.

ASBESTOS GIVES IT LONG-LASTING ENDURANCE UNDER SEVERE CONDITIONS

This Type AVA Rockbestos A.V.C. 600 Volt Power Cable and similar types rated up to 5000 volts give trouble-free performance under 230°F. operating temperatures and other severe conditions because:

- The impregnated asbestos braid is resistant to heat, corrosive fumes, moisture, oil, grease and flame.
- The felted asbestos wall beneath the braid won't dry out, crack or flow under high ambient temperatures.
- The moisture resistant high-dielectric varnished cambric is protected by two asbestos walls.
- The inner wall of impregnated felted asbestos withstands conductor-heating overloads and won't bake brittle or burn.

One of 125 different wires and cables designed by Rockbestos to meet severe or unusual operating conditions.

NEW EQUIPMENT

Strain Clamp Designed for Stranded Conductors

A NEW STRAIN CLAMP, No. 2115, illustrated, for all stranded conductors, except ACSR, has been announced by The Brewer-Titchener Corp., Cortland, N. Y. (The clamp for ACSR conductors was previously announced in ELECTRICAL WORLD, January 18, 1947, Page 194). Cable sizes from min. 0.187 in. to max. 0.4375 in. can be accommodated. However, the new clamp is not offered for use on the higher strength galvanized steel or all-Copperweld cables generally used as ground wires, the manufacturer reports.

The design of the new clamp is the familiar Snail-Shell Snubbing Type, but with an improved one-piece body pressed from heavy gage steel without riveted or welded joints, the company reports. This special construction is said to avoid "weeping of acid" after galvanizing. Keepers are of forged steel, with double-wave grip. The company reports that damage to conductors is prevented by the large snubbing radii, smooth die-formed U-shaped conductor seat and the large clamping section. Light weight, short connecting length and large cable-seat-radius of 6 in. at clamp mouth minimize the effects of cable vibration, the company states.

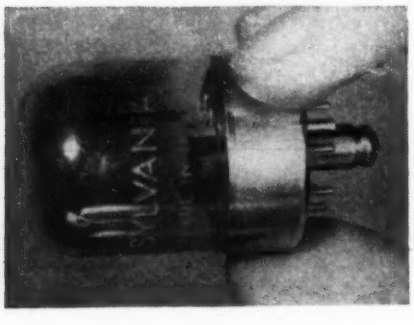
Installation of the clamp is simplified since a come-along loop is provided and only one clamping bolt need be removed. The clamp has more than adequate ultimate strength and will break, without slip, all conductors for which it is offered, it is reported.

•

Two New Double Triodes for UHF Applications

TWO NEW double triodes providing single-ended operation for cascade amplifiers operating at frequencies up to 400 mc. have been announced by the radio tube division, Sylvania Electric Products Inc., 500 Fifth Ave., New York 18, N. Y. The high mutual conductance tubes have independent elements with the exception of heaters permitting an appreciable saving in space and number of tubes required, the company reports.

Circuit applications include grounded-grid, cathode follower and push-pull amplifiers and converters in the new FM and television bands where low equivalent noise resistance obtained with triode converters is desirable. Type 7F8 is supplied with a 6.3-volt. 0.300-amp. heater. Similar ratings for type 14F8 are 12.6 volts and 0.150 amp. Heaters may be operated from an a.c. or d.c. source.



Direct interelectrode capacitances per section for both types when used with a 1⅛-in. diameter RMA M8-308 shield connected to the cathode, are as follows: grid to plate 1.2 uuf.; input 2.8 uuf.; output 1.4 uuf.; grid to grid (maximum) 0.1 uuf.; plate to plate (maximum) 0.5 uuf.; heater to cathode (external shield to ground) 2.8 uuf.

Typical operating conditions and characteristics per section for both types are as follows: plate voltage 250; self-bias resistor, ohms 500; plate current, ma. 6.0; mutual conductance, umhos 3300; amplification factor 48; grid volts for 10 ua. d.c. plate current 11.0; maximum grid circuit resistance, megohm ½.

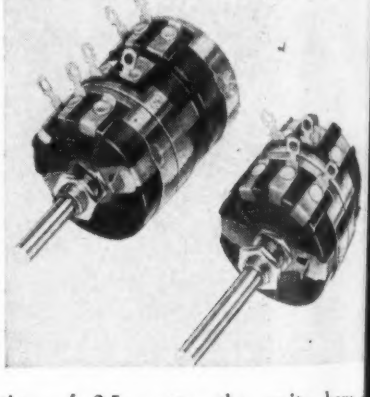
The tubes are supplied with lock-in RMA basing 8BW-L-O and measure 2⅝ in. over-all, 1⅛ in. diameter providing a seated height of 1¾ in. maximum. They may be mounted in any position.

•

Impedance of L and T Pads Ranges from 8 to 600 Ohms

WIRE-WOUND L-Pads and T-Pads for sound systems, covering impedance ranges from 8 to 600 ohms, have been announced by the General Electric Co., Thompson Rd., Syracuse, N. Y. The T-Pads may be used as variable attenuators in stable line impedance circuits while the L-Pads have application as individual volume controls for multiple speakers or as attenuation controls for constant impedance at either the source or load, according to the company.

Rated at a maximum power dissipation of 2.5 watts, the units have a continuous range of from 0.5 to 30 decibels attenuation in 90 deg. of rotation, the last 10 percent affording infinite attenuation, it was announced.



•

Switch Cuts Switchboard Instrument Testing Time

A NEW TEST SWITCH for rapid testing of switchboard instruments, meters, and relays from the front of the board has been announced by Westinghouse Electric Corp., Pittsburgh 30, Pa. Designed with up to ten elements and rated at 250 volts, 30 amp., combinations of current and potential switches are

HUBBARD AUTOGAP FUSE CUTOUT

NO. 2315

HUBBARD AUTOGAP FUSE CUTOUT is a combination of No. 2302, 9 KV Autogap Lightning Arrester with a new, improved 7-1/2 KV open type fuse cutout. The assembly is Stock No. 2315.

VOLTAGE, phase to ground is recommended to be limited to 7500 Volts.

FUSE rating is 50 Amperes. Fuse links are not furnished. Any standard can be used.

INTERRUPTING CAPACITY of the Hubbard Autogap Fuse Cutout is 1200 Amperes.

MOUNTING Brackets are available. No. 2323 for Crossarm and No. 2325 for pole. Specify type of mounting when ordering.

WEIGHT of the assembly is 18 Pounds each, packed for shipment.

CLOSED POSITION: The flat, phosphor bronze spring at the top is in tension, ready to kick out the mechanism instantly when the blowing of the fuse releases the tension.

OPERATING: This view shows the action during transition from "closed" to "open" positions. The fuse has blown and the toggle mechanism is forced open by the top contact spring. The gap caused by the blown fuse is instantly lengthened to at least 3-inches by the leverage of the toggle mechanism, causing the arc to be extinguished within the fibre fuse tube rather than at the top contacts, where burning might occur.

OPEN POSITION: Top contact spring is relaxed, having exerted its pressure toward opening the mechanism. Tube drops to hanging, open position which places the notch for "hot-stick" removal of fuse tube in an accessible spot

HUBBARD AND COMPANY

PITTSBURGH · CHICAGO · OAKLAND, CALIF.

4th among the features of DIEFLEX VARNISHED TUBING PRODUCTS IS . . .

Dielectric Strength

COMPLETE IMPREGNATION

FLEXIBILITY

NON-FRAYING

COMPLETENESS OF LINE

GOOD PUSH-BACK QUALITY

SMOOTH INSIDE BORE

UNIFORMITY OF PRODUCT

Dieflex tubing products have higher dielectric strength because they are soaked to saturation with specially formulated baking-type insulating varnishes, as many dips and bakes being given as are required to produce the particular grade being made.

All Dieflex products have superior qualities of resistance to heat, moisture, oil, and most chemicals, as well as long life, smooth inside bore, ability to resume roundness after cutting, non-fraying, and excellent push-back qualities.

INSULATION
MANUFACTURERS CORPORATION
ELECTRICAL INSULATION

* CHICAGO 6, 565 West Washington Blvd.
* CLEVELAND 14, 1231 Superior Ave., N. E.
MILWAUKEE 2, 312 East Wisconsin Ave.
DAYTON 2, 1315 Mutual Home Building

REPRESENTATIVES in: DETROIT 2, 11341 Woodward Ave., MINNEAPOLIS 3, 1208 Harmon Pl., and PEORIA 5, 101 Heinz Court.

cluded for the various types of instruments to be tested.

The company reports that safety and accuracy are increased by constructing the switch so that a plug properly connected to the test instruments can be used to check from the front of the board in rapid succession all meters or instruments of a particular type.

Known as Flexitest, it is enclosed in a black Moldarta case with a cover of similar material. Mounting is semi-flush on steel panels of any of the usual thicknesses. The width is such that it can be mounted on the same centerlines as standard instruments and relays.

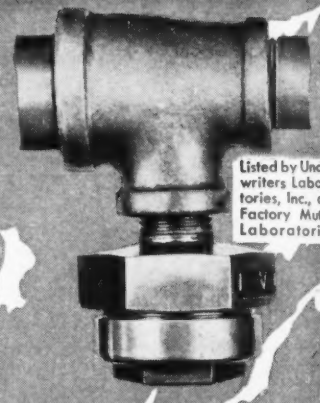
Individual switches are of the knife-blade type and separated by barriers. Switch handles are recessed for inserting identification cards. Each switch handle is drilled for insertion of an interlocking bar to tie together any three adjacent handles. Means are provided for the attachment of spring clips when individual test leads are used instead of a test plug.

•

Power Supplies for Relay And Instrument Testing

NEW packaged power supply units available in lightweight portable, or bench models, providing a source of a.c. and d.c. power adjustable from zero to maximum output range, have been announced by Arthur E. Booth Co., 210 West Seventh St., Los Angeles 14, Calif. The output circuits of both a.c. and d.c. are flexible as to connections for convenient routine testing and checking the calibration of a variety of instruments and relays. The present line supplies a full range of a.c. and d.c. currents up to 10 amp.; a.c. and d.c. potentials up to 750 volts. The units are available in five models all of which operate on 115-volt, 50/60-cycle circuits.

FIRE PAINTS BLACK PICTURES



Listed by Underwriters Laboratories, Inc., and Factory Mutual Laboratories.

BLAW-KNOX
Aquatomic
FOG NOZZLES

fight fire with these four distinctive features:

1 Non-clogging—clear free-flowing passages without screens.

2 Maintain spray pattern—even at reduced pressures in emergency.

3 Deliver powerful spray—strike to base of fire in spite of drafts and air turbulence, indoors or outdoors.

4 Maximum cooling and quenching effect—finely atomized spray takes the heat out of burning gases, liquids or other combustibles.

Write for details.

Also—

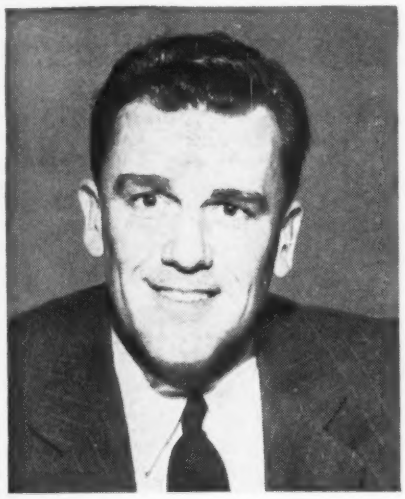
Blaw-Knox offers Standard Wet and Dry Pipe Automatic Sprinkler Systems as well as Thermostatically Controlled Pre-Action and Deluge Systems.

BLAW-KNOX
SPRINKLER DIVISION
829 Beaver Avenue, N.S.,
Pittsburgh 12, Penna.

NEWS ABOUT PEOPLE

Fahlen Made Vice-President of Central Arizona Utility

Central Arizona Light & Power Co., Phoenix, Ariz., recently divided its expanded territory into four divisions, and



F. T. FAHLEN, JR.

announced the election of F. T. Fahlen, Jr., as vice-president in charge of division operations.

Formerly assistant vice-president, Mr. Fahlen has complete charge of operations in the Phoenix area, and also has supervision of the divisions which were formed to better serve the needs of the company's growing service area.

With the exception of two years spent in military service, Mr. Fahlen has been connected with the Arizona utility for 13 years. Advancing in the ranks to the position of lighting engineer, he was made manager of the Tempe district in 1936 and later became Phoenix district manager. Four years later he was appointed supervisor of all districts. It was in July, 1946, that the board of directors elected him to the position of assistant vice-president.

•

▶C. C. CLARK of Ruth, Miss., has been elected president of the South Mississippi Electric Power Association, composed of ten REA cooperatives.

▶DAYTON E. HUSK has been appointed safety director of the New Jersey Power & Light Co., Dover, N. J., Mr. Husk started his utility career with the Metropolitan Edison Co. in Easton, Pa., in 1921 and was made supervisor of safety and accident prevention for New Jersey Power & Light Co. and the eastern division of the Metropolitan Edison Co. in 1929, continuing in that position until his new appointment. During the war years he was a special agent of the Department of Labor to promote industrial safety and health in Warren, Sussex. and Hunterdon Counties.

•

Olson Made Sales Manager of Idaho Power Co.

E. A. Olson has been appointed sales manager of the Idaho Power Co., Boise, succeeding R. S. Overstreet, who has been made division manager of the company's central division.

Mr. Olson has been with the company

E. A. OLSON

more than 18 years. He started in the central division of the company, becoming rural salesman, and later transferring to the general office on a special assignment. For several years, he was engaged as residential and farm sales manager. Three years ago, he was made assistant sales manager.

•

▶ROGER W. MACDONALD has been appointed manager of the electric light department of Middleboro, Mass., succeeding the late George A. Philbrook. He has been temporarily town manager, and interim manager of the above department following the death of Mr. Philbrook.

Puget Sound Utility Assigns Broader Duties to Kruse

Henry R. Kruse, general sales manager of the Puget Sound Power & Light Co., Seattle, has been named general

H. R. KRUSE

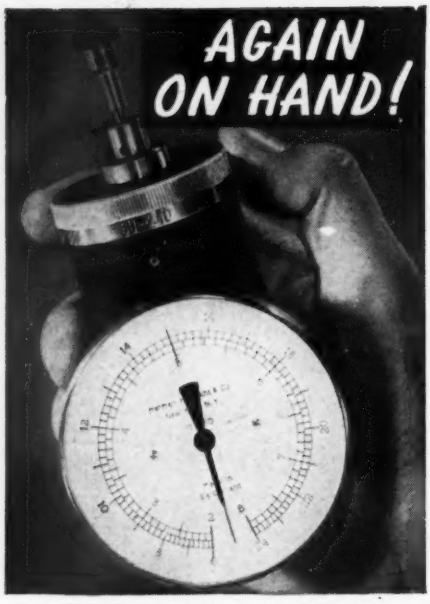
commercial manager. During his 24-year association with the utility he has worked in each of the company's six divisions in addition to assignments in the general offices.

Prior to his becoming general sales manager, Mr. Kruse was head of Puget Power's economic development and research department, division manager in Bellingham, sales manager in the company's northeastern and eastern divisions in Everett and Wenatchee and was assistant sales manager in Olympia and Bremerton.

When the Northwest Electric Light and Power Association holds its annual meeting in Seattle this spring, Mr. Kruse will head up the Business Development Section of the parley.

•

▶AUGUST C. KLEIN, vice-president of Stone & Webster Engineering Corp., has been awarded the honorary degree of doctor of engineering by the Stevens Institute of Technology. Dr. Klein was project engineer for the Stone & Webster organization from 1942 until 1945 in the design and construction of the electromagnetic plant for the Manhattan District at Oak Ridge. He also selected the site for the Clinton engineer works and engineered and man-



IMPORTED SWISS
5-RANGE, CENTRIFUGAL TYPE
HAND TACHOMETERS

CATLG. NO. 303	CATLG. NO. 346
30—120 RPM	120—480 RPM
100—400 RPM	400—1600 RPM
300—1200 RPM	1200—4800 RPM
1000—4000 RPM	4000—16,000 RPM
3000—12,000 RPM	12,000—48,000 RPM

FOR DETAILS WRITE FOR BULLETIN NO. 750. NO PRIORITY REQUIRED

HERMAN H. STICHT CO., INC.
27 PARK PLACE NEW YORK, N.Y.

HI-BOY SIGN
for Street and Highway Use

Will not blow over, leaving your men and the public unprotected.

Sign frame pivoted on each side allowing movement with varying wind pressures and full vision at all times.

Attractively and rigidly constructed folds compactly for storing.

COMPLETE INFORMATION ON NEW BULLETIN EW-37

IPCO
Safety Equipment for all Industries
INDUSTRIAL PRODUCTS COMPANY
2808 N. FOURTH STREET • PHILADELPHIA 33, PA.

aged the construction of the City of Oak Ridge. He joined Stone & Webster, Inc., as gas engineer in 1920 and later became chief mechanical engineer.

•

Fibre Conduit Co. Elects LeMieux Vice-President

Bernard G. LeMieux, formerly plant manager, has been elected a vice-president of the Fibre Conduit Co., Orangeburg, N. Y.

Mr. LeMieux joined the organization

B. G. LeMieux

in 1930 as assistant plant engineer. He was promoted to manager of the underfloor duct division in 1932, and made plant engineer in 1936. He advanced to chief engineer in 1937, became a director of research in 1939 and plant manager in 1945.

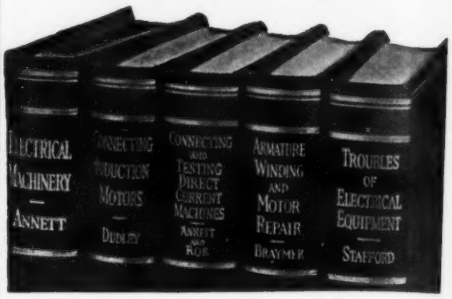
Mr. LeMieux is a member of the American Institute of Electrical Engineers and a member of the committee on commercial standards, National Bureau of Standards.

•

▶ Arthur L. Carvill has been appointed assistant manager sales, meter section, meter and instrument division of the General Electric Co. at West Lynn, Mass. Roy H. Mitchell has been named administrative assistant of the division and James M. Whittenton, assistant manager sales, instrument section. In the years before he joined G. E., Mr. Carvill was associated with several companies as a specialist in the design and selection of metering equipment, methods for its installation, and means of testing and maintenance. He served as chairman of several subcommittees in the national meter committees of the Edison Electric Institute and the Association of Edison Illuminating Companies. Mr. Mitchell joined the General Electric Co. in 1927 and in recent years has been connected with various departments in the company's meter

It's YOUR future—
Make the most of it!

Start now to earn the bigger pay in electrical repair



Was there ever such an opportunity to get started in electrical maintenance and repair—and at top-notch wages? Are you ready—with experience and ability—to cash in on it? Others are getting just the sort of background needed—quick! practical!—to handle the great variety of electrical maintenance and repair work TODAY—from this well-known electrical library. You can too!

Electrical Maintenance and Repair Library

5 volumes, 2042 pages, 1721 illustrations

Gives you the "know-how" to tackle any wiring or motor job. Five books show you HOW—to install all types of motor and generator units—to inspect and repair motor starters and generators—to diagnose motor and generator troubles—to figure new windings for old cores, DC and AC windings— to test armature windings, test induction motors, etc., etc. The new book is full of trouble-shooting charts that show quickly symptoms, causes, specific remedies, etc.

Includes trouble-shooting book

Now in addition to four well-known practical books on all details of testing, connecting, rewinding, installing and maintaining electrical machinery, the Library includes Stafford's *Troubles of Electrical Equipment*, a handy book giving helpful maintenance information, special trouble-shooting charts, explanations of symptoms and causes of machinery troubles, specific remedies, etc. This revised library gives you the ability to handle bigger jobs with surety of results.

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EXAMINATION COUPON

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Send me Electrical Maintenance and Repair Library, 5 volumes, for 10 days' examination. If I find the books satisfactory, I will send you $1.50 in 10 days, and $3.00 a month until $16.50 has been paid. Otherwise I will return the books postpaid.

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and instrument division. Mr. Whittenton entered the G. E. test course in 1929. His recent work has been in connection with instrument engineering. During the war, Mr. Whittenton worked with various government agencies and the American Standards Association to set up requirements for instruments to be used in war-time service.

■

A-C Makes Appointments in Electrical Department

New appointments in the switchgear and control sections and the electronic group of the electrical department of

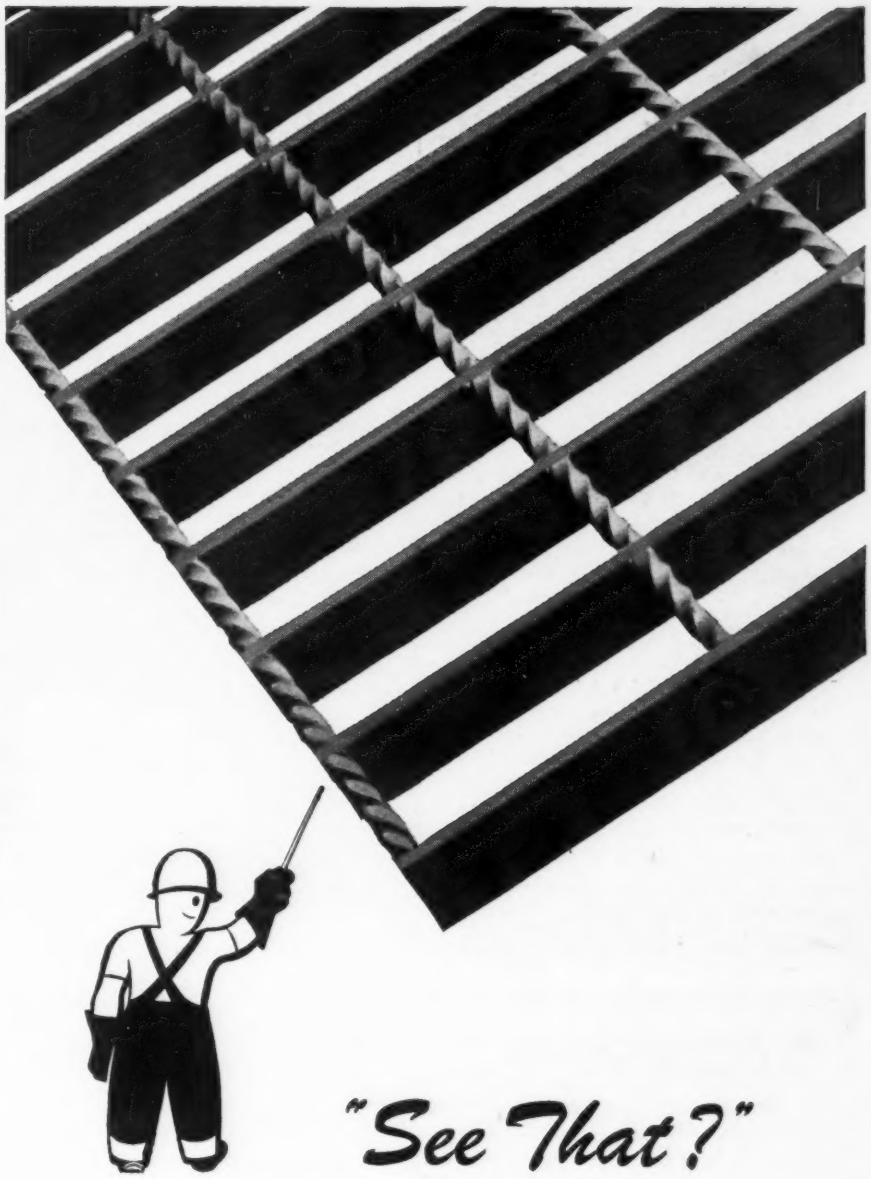
J. S. MORGAN

the Allis-Chalmers Mfg. Co., Milwaukee, Wis., have been announced by R. S. Fleshiem, manager of the electrical department.

J. S. Morgan is named engineer-in-charge of sales, switchgear and con-

T. G. A. SILLERS

trol sections; T. G. A. Sillers is appointed engineer-in-charge of development, switchgear and control sections; C. F. Kucera becomes sales engineer-in-charge of switchgear sales, assuming responsibilities previously



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That's the electroforged bond between the twisted cross bar and bearing bars which distinguishes Blaw-Knox Steel Grating — making it a rigid, one-piece "material" easy to install . . . Provides safe, sure footing at all times . . . admits maximum light and air.

BLAW-KNOX DIVISION of Blaw-Knox Company
2013 FARMERS BANK BUILDING
PITTSBURGH 22, PA.

BLAW-KNOX ELECTROFORGED STEEL GRATING

EVERSTICK ANCHORS...

FOR SPEED IN INSTALLATION

The exclusive Everstick nut housing locks the Anchor firmly on the rod. This speeds up installation. Plates are so designed, that they expand easily into undisturbed earth, and extra holding power is achieved. Made of tough rust-resistant malleable iron. Write for bulletin.

EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

Reduce Line Clearing Costs with SEYMOUR SMITH TELEPHONE PRUNERS

This powerful pruner cuts closer, is stronger than any other similar tool on the market. Can be operated in close tangled growth; cutting easily and cleanly branches up to 1½" in diameter. No trouble with spring breakage.

Here is the only pruner with the famous Seymour Smith "Center Cut" construction; safety catch to lock blade closed; one piece tempered tool steel blade; reinforced hook; extra long life spring; ball bearing pulley; highest quality chain; unbreakable iron head.

Designed by experts for experts; demanded by public utility companies everywhere, it will pay you to write for literature and prices.

SEYMOUR SMITH & SON, Inc.
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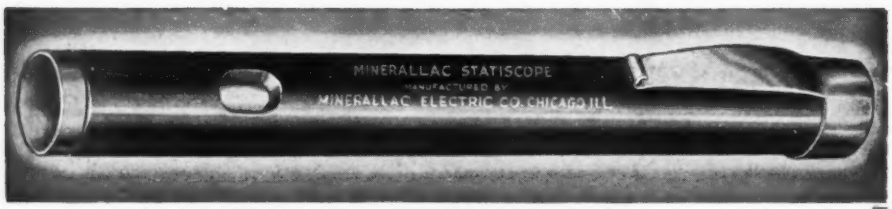

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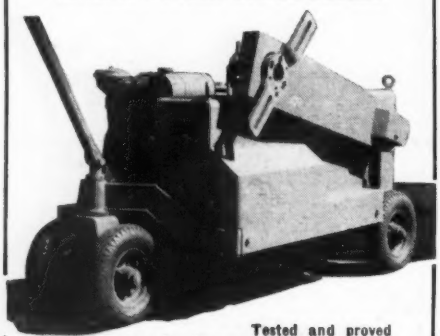

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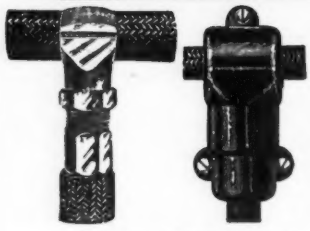

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handled by Mr. Morgan, and E. J. Rathsack is named engineer-in-charge of the electronic group.

Mr. Morgan, in his new capacity, will directly supervise sales and commercial matters in the switchgear and control sections and the electronic groups. He will also coordinate sales and commercial affairs of the Boston Works circuit breaker section with those of the West Allis sections, which are directly under his supervision. He joined Allis-Chalmers' graduate training course in 1935 following his graduation from Purdue University. Before assuming his present position, he served the company successively as salesman in the Knoxville branch office, manager of the Knoxville office, application engineer in switchgear sales, sales engineer-in-charge of switchgear sales, and engineer-in-charge of sales, switchgear and control sections.

Mr. Sillers will have direct supervision of the company's short circuit test laboratory and will supervise all test and research work conducted in this laboratory. In addition, he will coordinate the development work conducted by the switchgear and control sections, the electronic group, and the Boston Works circuit breaker section. An alumnus of the University of Manitoba, Mr. Sillers entered Allis-Chalmers' employ in 1925 following graduation. Holder of several patents, he was assistant engineer-in-charge of switchgear design prior to his promotion. Like Mr. Morgan, he is a member of the American Institute of Electrical Engineers.

Mr. Kucera became associated with Allis-Chalmers in January, 1946. Prior to entering the Navy in 1942, he was successively employed by the Interstate Power Co., Washington Water Power Co., and the Bonneville Power Administration. Mr. Kucera is also a member of A.I.E.E.

Mr. Rathsack, who entered the employ of Allis-Chalmers in 1944 as an assistant engineer in the electronic devices section of the electrical department, has served successively since then as engineer and acting engineer-in-charge of the section.

•

► A. U. STEARNS, formerly assistant manager, has been appointed manager of the Menominee and Marinette Light & Traction Co., following the retirement of H. H. FISHER. Mr. Fisher will be available to the company for consultation. WILLIAM LEMKE has been named superintendent of the electric and gas distribution department, succeeding W. P. ISTAS, retired. WALTER F. NELSON has been appointed manager of steam stations of the Wisconsin Public Service Corp., which controls the

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Menominee and Marinette properties. He is responsible for maintenance and operation of Bayside, Oshkosh and Manitowoc stations.

OBITUARY

▶ LESTER L. KRAFT, general superintendent of the Union Electric Co.'s plant at Venice, died on January 16 of a heart ailment. Mr. Kraft became identified with Union Electric in 1917.

▶ RUSSELL V. SANFORD, electrical superintendent for the Tucson (Ariz.) Gas, Electric Light & Power Co., died suddenly on February 13 in that city at the age of 54. Mr. Sanford joined the Tucson utility in 1919 as assistant electrical superintendent, which position he held until 1923 when he was promoted to the position he held at the time of his death. Mr. Sanford received a War Department citation in 1945 for designing and installing electric systems feeding war plants in the Tucson area. He was a member of the American Institute of Electrical Engineers.

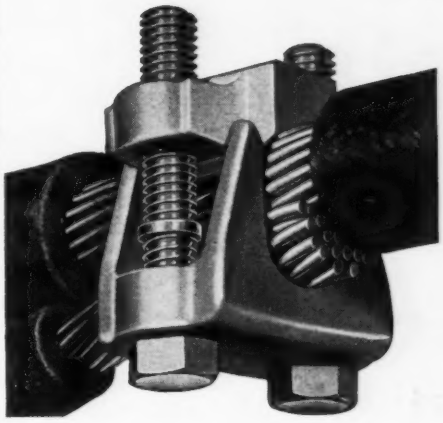
▶ HERMAN W. FALK, chairman of the board and founder of the Falk Corp., Milwaukee, Wis., died on February 17 at Daytona Beach, Fla., after suffering a heart attack aboard his houseboat. He was 79 years old. Mr. Falk also was a member of the executive committee of the Allis-Chalmers Mfg. Co., a member of the board of the Heil Co., and president of the Falk Investment Co. and the Hope Investment Co.

▶ PAUL B. HULL, assistant superintendent of electric distribution, Public Service Co. of Colorado, died suddenly on January 5 as the result of a heart attack. Mr. Hull was 59 years old. He had been with the company since 1905.

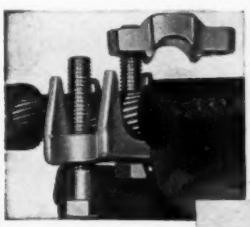
▶ M. H. PITTMAN, 68, chief operator of the Grady substation of Georgia Power Co., died on February 5 following a long illness. Mr. Pittman had been with the utility for 42 years.

▶ JAMES B. PARROTT, 64, a representative of the Federal Power Commission, died February 4 in a private hospital in Atlanta. He had been in ill health for four years. Mr. Parrott was born in Laurens County, S. C., November 12, 1892. Following service in World War I, he was elected superintendent of the Water and Light plant in Bishopville, S. C. In 1923 he established the Parrott Electric Co. in Clinton, S. C. In 1934 he joined the Federal Power Commission and a few years later moved to Atlanta as its representative.

MATTHEWS UNICLAMP CONNECTORS

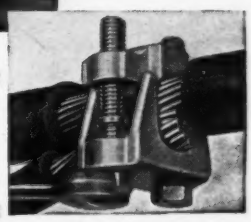


Made for use on copper or aluminum wires from 2/0 to 1000 MCM inclusive. They will connect two wires of their rated size or one wire of their rated size with one or more smaller tap-off wires down to No. 8 solid. They have many advantages over the larger sizes of connectors of the split bolt and other designs as they provide greater pressure between wires, hence greater holding power, are less costly, are easier to install and the assembled design is such that parts cannot become separated.



Fit on conductor as shown. Position top member and partially thread in free bolt.

Insert tap wire and equally draw up both bolts.



Write for Bulletin 206

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Federal Inaction on Copper Legislation Bringing Drive for Investigation

A Congressional stalemate on the problem of boosting copper imports is prompting consumer industries to drive for an investigation. The heavy copper consuming concerns are hopeful of bringing about early elimination of the tariff, in the face of an even greater squeeze in the domestic supply.

Immediately concerned are the electrical manufacturing industry, public utilities and allied business organizations. Spokesmen of several of these industries have already conferred with members of Congress in an attempt to obtain early action on this question. (See editorial, this issue, Page 41.)

Shortage Increasing

At the present time the country is faced with a shortage of between 35 and 40,000 tons per month. This, shortly, is expected to rise to more than 50,000 tons per month. Domestic production of refined copper is presently averaging about 65,000 tons monthly, while the demand is approximately 130,000 tons. The federal government has ceased the purchase of foreign copper and thereby has increased the acuteness of the problem.

The government's stockpile is negligible, with only 7,500 to 9,000 tons of duty free copper available for allocation in March. Another 10,000 tons of dutiable metal, which would cost about 21½ cents per pound, is tied up pending an RFC decision of whether or not to sell this amount over the present market price of 19½ cents. In any event, it appears that March will see the practical end of government allocation of the metal.

Private purchase has been impossible so far this year because of government contracts with South American producers. In addition the price-tariff condition, now before Congress, is stated to make private importation economically prohibitive. The world price, plus shipping charges and duty, would make the metal cost approximately 25 cents per pound, which is about 5½ cents above the present domestic price.

Even if purchases were made abroad the trade reports a 60-day time lag would occur between contract and delivery from South America. For this reason it is believed that it would be June 1 before any appreciable amount of copper could reach American ports.

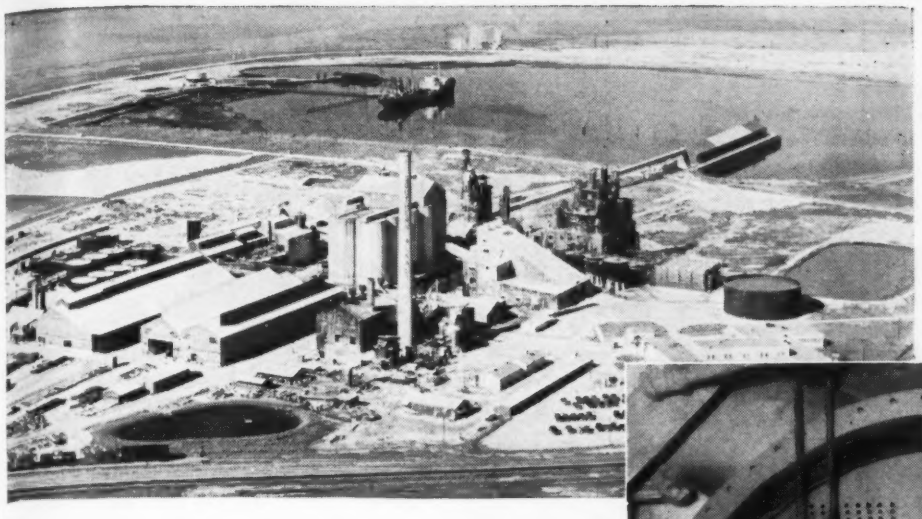
The National Rural Electrification Co-operative Association, representing 650 co-ops, has already told Congressmen that the copper shortage is paralyzing extension of services and is endangering present transmission line plans. Shortages of conductors and transformers are preventing completion of hundreds of projects, the Association claims.

General Electric and Westinghouse report transformer plants now running at 65 percent of capacity and facing further cuts in production unless supplies increase in the near future. Copperweld, large suppliers of wire for rural projects, reports that it will be out of copper within two months if present conditions continue. The National Electrical Manufacturers Association is expected to discuss the copper problem at its March 3 meeting in Chicago and to go on record as disapproving Congressional inaction. The Illinois Manufacturers' Association last week went on record advocating repeal of the tariff.

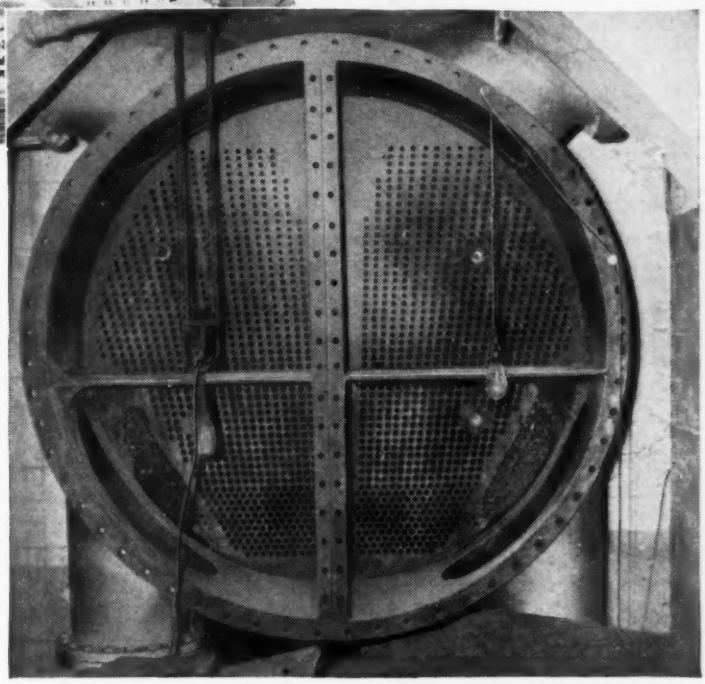
The stalemate stems from the opposition of several copper-state legislators to Rep. James T. Patterson's (Conn.) bill calling for the repeal of the 4-cent duty. Patterson has stated that he is not wedded to any definite plan other than a temporary moratorium on the duty and suggests that the tariff waiver apply only to the first 400,000 tons of imported metal each year. The bill is slated for scrutiny by the House Ways and Means Committee but, of necessity, must await completion of other tax matters.

Rep. John R. Murdock, Arizona, chief

WELCOMES EXECUTIVE STAFF—Members of the executive staff of Electromaster, Inc., are greeted by R. B. Marshall, president, at the recent opening of the company's offices in its new three-quarter million dollar Mount Clemens plant. Left to right: President Marshall; Gerald Hulett, vice-president; J. A. Bell, director of utility sales; R. B. Blanchard, director advertising; E. R. Genthe, secretary-treasurer; H. H. Hubbard, vice-president; C. A. Jakeway, assistant secretary-treasurer; D. W. Scofield, research and experimental engineer; W. F. Ouderkirk, manager production standard; E. A. Gartha, superintendent; E. C. Seabright, director of quality control; H. H. Munro, director of purchasing; R. J. Megargle, industrial consultant



● *Highly corrosive salt water from the Corpus Christi ship channel is the cooling medium for this condenser at the Southern Alkali Corporation plant, Corpus Christi, Texas. Anaconda Super-Nickel was selected for this retubing job because of its superior resistance to corrosion by salt water.*



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opponent of the Patterson proposal, does not favor any tariff reduction. In a speech February 4, the day Patterson's bill was introduced, Murdock stated "we can supply our own domestic requirements if the price permits:

"1. Full operation of our mines.

"2. Development of new ore bodies. (He claimed that a 100-million ton deposit had been proved by drilling in Arizona.)

"3. Mining of fringe or marginal ore.

"4. Production of copper from ores of below average grade through advanced mining and metallurgical practices."

The Arizona legislator stated that the development of new ore bodies, mining or marginal ores, and production through advanced mining and metallurgical practices "was not possible during the war." He did not state what price would permit "supplying our own copper requirements," nor did he mention the war-time premium price plan for copper, lead and zinc which expires June 30 unless renewed by Congress.

In a later statement, Murdock said he believed the high production achieved during the war through the premium price plan could be continued if a 5-cent premium were continued. He admitted he had not contacted western mining interests, other than the Arizona Copper Tariff Board, on industry's reaction to the tariff or moratorium. However, it was evident early last month that some of the larger producers and most of the fabricators were in favor of a temporary suspension of the tariff.

•

Issues "Technical Advisor" on Aluminum Mill Products

To meet the insistent growing demand for technical information on fabricating and processing aluminum in all its forms, Reynolds Metals Co. has inaugurated a new service to the metal-working industries by establishing the *Technical Advisor*, a monthly technical paper devoted to publicizing latest recommendations on how to use aluminum mill products most effectively.

The first issue of the paper carried a condensed technical description of the two main processes in the production of aluminum—the Bayer process of producing alumina from bauxite, and the Hall process for reducing alumina to metallic aluminum.

•

Japan to Send Scrap Lead

Reconstruction Finance Corporation has announced that its subsidiary, the U. S. Commercial Co., expects to re-

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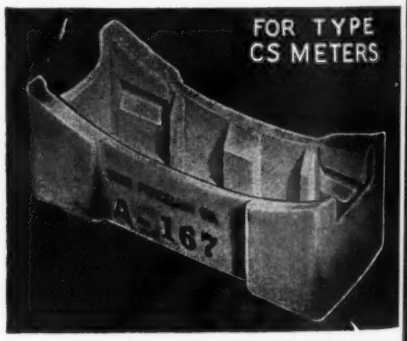

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ceive approximately 500 tons of scrap lead from Japan about March 15. This material will be sold in 100-ton lots f.o.b. cars at dock Pacific Coast port, probably Tacoma, Wash., on a sealed bid basis.

•

Industry Included in FCC Ruling on HF Band

The Federal Communications Commission has recently ordered that the frequency 2,450 megacycles be reserved for industrial, medical and scientific purposes upon a non-exclusive basis. Operation for such purposes upon the frequency 2,450 megacycles may be conducted without a license only under the following conditions:

(1) The emissions of radio-frequency energy resulting from such operation shall be confined to that portion of the spectrum between 2,400-2,500 megacycles.

(2) The energy radiated and the band width of emissions of all industrial, medical and scientific equipment operated as provided for herein shall be reduced to the greatest extent practicable. No interference shall be caused to authorized communication services from spurious or harmonic radiations. In the event of such interference, from spurious or harmonic radiations, operation of the equipment causing such interference shall cease and shall not be resumed until steps necessary to eliminate such interference have been taken.

(3) Operation upon the assigned frequency as specified above shall be subject to such future regulations as may be found by the Commission to be appropriate.

•

Asks U. S. to Continue Purchase of Rubber

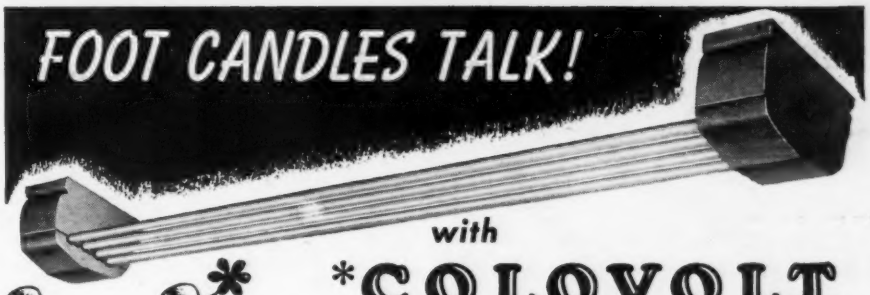
Rubber manufacturers will soon ask Congress to continue public purchase of rubber until next September 30, in order to assure adequate supplies to the United States. The rubber manufacturers believe that the government "is the only one" to deal with foreign rubber cartels that control the world rubber market.

•

Washer Sales Set Record

Factory sales of household washers in 1946 broke all records, totaling 2,023,981, compared to 1,959,887 in 1941, final prewar year of full production, according to the American Washer and Ironer Manufacturers' Association. Ironer sales were 124,616, compared to 215,994 in 1941.

FOOT CANDLES TALK!



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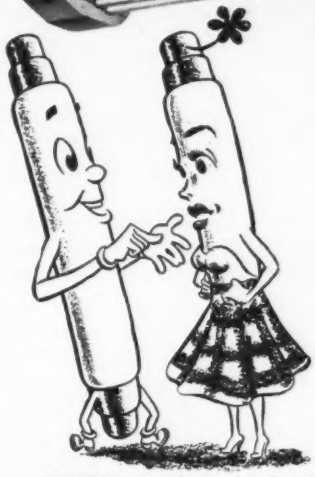

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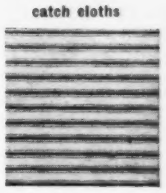

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Technical Apparatus Co.	165 Washington St.
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CANTON, MASS.	
Tobe Deutschmann Corp.	863 Washington St.
CHICAGO, ILL.	
American Condenser Co.	4410 Ravenswood Ave.
Majestic Radio & Television Corp.	125 W. Ohio St.
EMPORIUM, PENN.	
Sylvania Electric Products, Inc.	
FORT WAYNE, IND.	
Essex Wire Corp.	1601 Wall St.
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Cole Instrument Co.	1320 S. Grand Ave.
Hoffman Radio Corp.	3761 S. Hill St.
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Electronic Corp. of America	353 W. 48th St.
Emerson Radio & Phonograph Corp.	76—9th Ave.
Hammarlund Mfg. Co., Inc.	460 W. 34th St.
Newark Electric Co., Inc.	242 W. 55th St.
Raytheon Mfg. Co.	60 E. 42nd St.
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